# Preliminary Adopted

## Technical Specification

## for

## Onsite Sewage Systems

## (2003 Edition)

**Indiana State Department of Health**

January 8, 2003

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# Chapter 1 Introduction

This technical specification is adopted by *410 IAC 6-8.2*, and is enforced as part of that administrative code. It provides minimum specifications for the design, location, installation, construction, maintenance, and operation of onsite systems.

## I. Applicability

This technical specification applies to the following:

- Residential onsite systems.
- Commercial facility onsite systems.
- Cluster onsite systems.
- Gravity sewer and force main extensions to a sewerage system for a regulated facility.
- Experimental and alternative technology onsite systems.

This technical specification provides minimum specifications for onsite systems. Although housing subdivisions and other moderate to high-density land development may qualify for individual onsite systems, consideration should first be given to other sewage treatment methods. Other methods for sewage treatment include cluster onsite systems and sewerage systems (see *Appendix A, Glossary* for definitions of these terms). If a cluster onsite system is used, an ongoing operation and maintenance program is required.

The soil absorption field for a cluster onsite system may include any design described in this document using the site and onsite system requirements of *Chapter 3* and the sizing requirements of *Chapter 5*. Experimental or alternative soil absorption field technology may be considered provided the additional requirements for experimental or alternative technology onsite systems of *410 IAC 6-8.2-53 and 54* and *Chapter 8* of this document are met.

## II. Definitions

A. The following nine definitions are critical to the understanding and application of this technical specification:

1. **Department:** Indiana state department of health.
2. **Local health department:** as defined in *IC-16-18-2-211*, “a department organized by a county or city executive with a board, a health officer, and an operational staff to provide health services to a county, city, or multiple county unit.”
3. **Onsite system:** all equipment and devices necessary for proper onsite conduction, collection, storage, and treatment of sewage, and absorption of sewage in soil, from a residence or commercial facility.
4. **Residence:** a single structure used or intended to be used for permanent or seasonal human habitation for sleeping one (1) or two (2) families.

5. **Commercial facility:** any building or place not used exclusively as a residence or residential outbuilding. Commercial facilities include, but are not limited to, an office building, a manufacturing facility, a single structure used or intended to be used for permanent or seasonal human habitation for sleeping three (3) or more families (apartment, multiplex, townhouse, or condominium), a motel, a restaurant, a regulated facility, and any grouping of residences served by a cluster onsite system.
6. **Residential onsite system:** onsite system for a residence or a residential outbuilding.
7. **Commercial facility onsite system:** onsite system for a commercial facility.
8. **Soil:** natural, non-filled, mineral or organic matter on the surface of the earth that shows the effects of genetic and environmental factors. These factors include climate (water and temperature effects), microorganisms, macro-organisms, and topography acting on a parent material over time.
9. **Soil absorption field:** the portion of the onsite system into which effluent discharges for absorption by the soil.

B. See *Appendix A, Glossary*, for additional definitions.

# Chapter 2 Administrative Authority & Plan Submittal

This chapter defines the responsibilities of property owners, the authority of local health departments and the department, and requirements for a plan submittal.

## I. Authority and Responsibilities

A. The owner or agent must:

1. Obtain a written:
   a. Construction permit for the installation and construction of an onsite system as required in *410 IAC 6-8.2-46(a)*.
   b. Approval letter for the installation and construction of an onsite system as required in *410 IAC 6-8.2-47(a)*.
2. Provide an application and plan submittal as required in *410 IAC 6-8.2-44* and described in *Section II through V* of this chapter.
3. Provide a plat or aerial photograph for the written site evaluation, as required in *Section II. C. 1.* of this chapter.

B. The authority for onsite system approval is as follows:

1. The local health department has authority for issuing construction permits as described in *410 IAC 6-8.2-42(a), 46,* and operating permits as described in *410 IAC 6-8.2-48*.
2. The department has authority for issuing approval letters as described in *410 IAC 6-8.2-42(b) and 47*, and operating permits as described in *410 IAC 6-8.2-48.*
3. The department has authority to delegate plan review and construction permit issuance to local health departments, and the authority to revoke such delegation, as described in *410 IAC 6-8.2-42(c)*.

C. The department or local health department has the authority to deny, modify or revoke a permit as described in *410 IAC 6-8.2-50.*

D. Responsibility for assuring that an onsite system complies with *410 IAC 6-8.2*, this technical specification, all local ordinances, and the requirements of the construction permit or approval letter, as applicable, is as follows:

1. The local health department is responsible for inspections as described in *410 IAC 6-8.2-49(b) and (g)*.
2. The design engineer or architect is responsible for inspections as described in *410 IAC 6-8.2-49(c)*.

E. The department or local health department has the authority to issue an order to stop work as described in *410 IAC 6-8.2-57(d).*

## II. Plan Submittal: Written Site Evaluation Report

A written site evaluation report includes soil absorption field site characteristics, a soil profile report, and soil profile characteristics.

## A. Written Site Evaluation Report

1. The plan submittal for a construction permit or approval letter must include a written site evaluation report.
2. Written site evaluation reports must comply with the requirements of *410 IAC 6-8.2-45*.
3. A written site evaluation report must:
    a. Be provided for all sites proposed for a new or replacement soil absorption field as required in *410 IAC 6-8.2-45(a)*; and
    b. Use terminology contained in guidelines, soil manuals, technical bulletins, and handbooks of the NRCS.

## B. Soil Absorption Field Site Characteristics

The following are required in the written site evaluation report.

1. Name of the soil map unit listed on the soil survey atlas sheet for each soil sample site at the proposed soil absorption field site.
2. Names of any soil map units at the soil absorption field site that are hydric or have inclusions of hydric soils.
3. All topographic features affecting the soil absorption field including, but not limited to the following:
    a. Position (upland, terrace, or floodplain).
    b. Percent slope, slope shape, and slope aspect.
    c. Surface drainage characteristics shown to scale or with measurements on a copy of the plat plan, including:
        1) Location of all lakes, ponds, reservoirs, rivers, streams, creeks, ditches, or swales.
        2) Location of all surface topography where surface runoff may collect or pond.
4. Type of vegetative cover at the site.
5. The name and signature of the person conducting the site evaluation.

## C. Soil Profile Report

The following are required in the written soil profile report.

1. The description of at least three (3) sample sites for each proposed soil absorption field site.
    a. Additional sample sites, or the use of soil pits, may be required to characterize the topography(ies) or soil(s) at the soil absorption field site where changes in topographic features or variation in soil properties necessitate further evaluation.
    b. For commercial facility onsite systems with design daily flow of greater than seven hundred and fifty (750) gallons per day, additional sample sites may be required.
    c. Soil sample sites must be located using one of the following methods:
        1) Measured from a permanent fixed point or points on the property and shown to scale or with measurements on a copy of:
            a) The plat provided by the owner or agent prior to the site evaluation; or

b) A plan commission aerial photograph, showing the property lines, provided by the owner or agent prior to the site evaluation; or

2) Flagged or staked, measured by a designer, professional engineer (P.E.) registered in Indiana, or architect registered in Indiana (agent of the owner) from a permanent fixed point or points on the property, and shown to scale on the site plan. The designer, P.E., or registered architect (agent of the owner) must be present when the site evaluation is performed; or

3) Using the global positioning system (GPS) and shown to scale or with measurements on a copy of:

a) The plat provided by the owner or agent prior to the site evaluation; or

b) A plan commission aerial photograph, showing the property lines, provided by the owner or agent prior to the site evaluation.

2. An evaluation and description of the soil characteristics of all sample sites.

a. A cross-reference may be made to a similar sample site that has been fully described. When such cross-reference is made, all differences must be described.

b. Soil profiles must be recorded to:

1) A depth of sixty-six (66) inches or until a layer is encountered which cannot be readily penetrated, whichever is shallower, for sites that do not require site drainage, or where the depth of the subsurface perimeter drain meets the requirement of *Chapter 4, Section II. B. 1. b. 2) b)*.

2) A depth of eighty (80) inches or until a layer is encountered which cannot be readily penetrated, whichever is shallower, for sites where the calculation of the depth of the subsurface perimeter drain will be performed to meet the requirements of *Chapter 4, Section II. B. 1. b. 1) a)*.

3) A depth of eighty (80) inches or until a layer is encountered which cannot be readily penetrated, whichever is shallower, for sites where the soil is on the department list for soils with a nitrate leaching index of greater than ten (10), as required in *Chapter 3, Section VI. A. 3.*

c. The evaluation and description of soil characteristics must use terminology contained in guidelines, soil manuals, technical bulletins, and handbooks of the NRCS.

## D. Soil Profile Characteristics

The following characteristics must be recorded for each sample site:

1. For each individual soil horizon:

a. Horizon depths.

b. Soil structure, consistence, texture, and textural modifiers.

c. Munsell® notation for soil colors (matrix, mottles, coatings and clay films).

d. Redoximorphic features.

e. Percent coarse fragments by volume.

f. Effervescence, if present (slight, strong, or violent).

g. Roots, if present (abundance, size, and location).

h. Densic material or fragic soil properties, if present.
i. Parent material.

2. For each soil profile:
   a. Depth to seasonal high water table as determined by redoximorphic features.
   b. Depth to a layer with a soil loading rate of less than twenty-five hundredths (0.25) or greater than one and twenty hundredths (1.20) gallons per day per square foot (*see Appendix C, Figure 3-4, Soil Loading Rates*).
   c. Depth to any layer which has a soil loading rate equal to one and twenty hundredths (1.20) gallons per day per square foot (*see Appendix C, Figure 3-4, Soil Loading Rates*).
   d. Soil particle size family classification.
   e. Whether it is a hydric soil or not.
3. Discrepancies, if any, for each soil sample site, between the soil description and the characteristics of the soil map unit listed on the soil survey atlas sheet.

## III. Plan Submittal: Site Plan & Design Specifications

A. The plan submittal for a construction permit or approval letter must include a site plan and design specifications.

B. Before the start of any construction on the property, the location of the soil absorption field and dispersal area (see *Chapter 3*), site drainage, set aside area (if required), and areas designated for future expansion (if required) must be staked out and protected from disturbance.

C. A plan submittal must include, but is not limited to, the following:

1. For a residence and residential outbuilding, a floor plan showing the number of bedrooms plus the number of bathtubs and jetted tubs with capacities greater than or equal to one-hundred and twenty-five (125) gallons.
2. For a commercial facility, the type of establishment and calculations for determining sewage flows.
3. Legally recorded information on the property, including:
   a. Plat;
   b. Legal description; and
   c. Easements and right-of-ways.
4. Invert elevations of all piping at inlets and outlets.
5. Specifications of, or listing of department approved, components.
6. For commercial facility onsite systems not delegated to local health departments, a professional engineer (P.E.) registered in Indiana, or an architect registered in Indiana, must certify the site plan.
7. If the onsite system has a pump, the design specification must show calculations for dose volume, total dynamic head (TDH) and total discharge rate (TDR), and include the pump curve for the pump specified for the onsite system (see *Chapter 5, Section VIII*).

D. For residential onsite systems, site plans and design specifications must include, but are not limited to, either *Section III. D. 1. or 2*. of this chapter, as required by the local health department. For commercial facility onsite systems, site plans and design specifications must include, but are not limited to, Section *III. D. 1*. of this chapter.

1. A drawing of the onsite system site, to scale, and a detailed plan view of all onsite system components.
   a. A drawing of the onsite system site, to scale, must include the following:
      1) Direction of geographic north.
      2) Benchmark elevation and location.
      3) Property boundaries, or reference of structure(s) and the onsite system to property boundaries.
      4) Footprint of all structures, existing and proposed.
      5) Existing and proposed sewer outlets.
      6) Setbacks and separation distances required in *Figure 3-1, Minimum Separation Distances*, by local ordinance, as recorded on the property deed, and as required in subdivision covenants.
      7) Location of all existing and proposed:
         a) Water supply wells within one hundred (100) feet of the onsite system.
         b) Public water supplies within two hundred (200) feet of the onsite system.
      8) All trees and shrubs that will affect construction of the proposed soil absorption field.
      9) Location of all soil sample sites.
      10) Surface drainage characteristics including:
         a) Location of all lakes, ponds, reservoirs, rivers, streams, creeks, and ditches within fifty (50) feet of the proposed onsite system.
         b) Location of all surface topography, where surface runoff may collect or pond, that may affect the proposed onsite system.
      11) Type of vegetative cover at the site.
      12) If applicable, elevation of the regulatory (base) flood:
         a) As determined by the Indiana Department of Natural Resources (IDNR); or
         b) As calculated by a method and procedure which is acceptable to and approved by IDNR.
      13) If applicable, elevation of the 100-year storm event pool level of a reservoir:
         a) As determined by the Indiana Department of Natural Resources (IDNR); or
         b) As calculated by a method and procedure which is acceptable to and approved by IDNR.
   b. A detailed plan view of all onsite system components must include the following:
      1) Location of all pipes, tanks, secondary treatment device(s), effluent distribution device(s), and soil absorption field(s).

2) Requirements for trench onsite systems.
    a) For residents:
        i) Show or list existing grade elevations of the centerline of each trench at both ends and midpoint of each trench; and
        ii) Show arrows indicating the direction(s) of slope.
    b) For commercial facilities, show contour lines at intervals of one (1) foot or less.
    c) By calculation, provide the percent slope within the soil absorption field.
    d) Provide a detailed cross section of a typical trench showing proposed depth.
3) Requirements for sand mound onsite systems.
    a) For residents:
        i) Show or list existing grade elevations at:
            (1) The four corners and the midpoints between the corners along the length of the aggregate bed; and
            (2) The four corners and the midpoints between the corners along the length of the basal area; and
        ii) Show arrows indicating the direction(s) of slope.
    b) For commercial facilities, show contour lines at intervals of one (1) foot or less.
    c) By calculation, provide the percent slope within the soil absorption field.
    d) Provide a detailed cross section of the soil absorption field showing the proposed depth of the sand below the aggregate bed.
4) If an onsite system drainage system is required:
    a) For a surface diversion, show the surface diversion on the detailed plan view.
    b) For onsite system subsurface drainage, show the subsurface drainage system on the detailed plan view.
        i) Show the locations and elevations of existing grade and drainpipe inverts at each corner of the subsurface drain as measured from the benchmark.
        ii) Show the location and invert elevation of the onsite system subsurface drain outlet as measured from the benchmark:
            (1) If the outlet drains to the ground surface, show the elevation of existing grade at the outlet; or
            (2) If the outlet drains to a subsurface drain, show the elevation of the invert of the subsurface drainpipe.
    c) Provide a detailed cross section of the subsurface drain trench showing proposed depth and trench bottom cross section as derived from *Figure 4-1, Drain Trench Cross Sections*.

2. A sketch of the onsite system on a copy of the plat (with measurements), identification of the onsite system on the property, and required consultation with the local health department.
    a. A sketch of the onsite system site on a copy of the plat, with measurements, must include the following:

1) Direction of geographic north.
2) Benchmark elevation and location.
3) Footprint of all structures, existing and proposed.
4) Existing and proposed sewer outlets.
5) Location of all existing and proposed:
    a) Water supply wells within one hundred (100) feet of the onsite system.
    b) Public water supplies within two hundred (200) feet of the onsite system.
6) For trench onsite systems:
    a) The location and elevation of the four (4) corners of the soil absorption field as measured from the benchmark.
    b) In a separate sketch, provide a cross section of a typical trench showing proposed depth.
    c) If the depth of any trench varies from the depth of other trenches in the soil absorption field, provide in the design specifications the depth of each trench from existing grade at the centerline of the trench.
7) For Sand mound onsite systems:
    a) The location and elevation of the four (4) corners of the aggregate bed and basal area as measured from the benchmark.
    b) In a separate sketch, provide a cross section of the soil absorption field showing the proposed depth of the sand below the aggregate bed.
8) Surface drainage characteristics including:
    a) Location of all lakes, ponds, reservoirs, rivers, streams, creeks, and ditches within one hundred (100) feet of the proposed onsite system.
    b) Location of all surface topography, where surface runoff may collect or pond, that may affect the proposed onsite system.
9) If an onsite system drainage system is required:
    a) The location of the surface diversion.
    b) For onsite system subsurface drainage, sketch the subsurface drainage system.
        i) Show the locations and elevations of existing grade and drainpipe inverts at each corner of the subsurface drain as measured from the benchmark.
        ii) Show the location and the invert elevation of the onsite system subsurface drain outlet as measured from the benchmark:
            (1) If the outlet drains to ground surface, show the elevation of existing grade at the outlet; or
            (2) If the outlet drains to a subsurface drain, show the elevation of the invert of the subsurface drainpipe.
    c) In a separate sketch, provide a cross section of the subsurface drain trench showing proposed depth and trench bottom cross section as derived from *Figure 4-1, Drain Trench Cross Sections*.

b. Identify the following on the property with flags, stakes, paint, or other visible markings acceptable to the local health department:
    1) Property boundaries within one-hundred (100) feet of the onsite system.
    2) Setbacks and separation distances required in *Figure 3-1, Minimum Separation Distances*, by local ordinance, as recorded on the property deed, and as required in subdivision covenants.
    3) If applicable, the regulatory (base) flood:
        a) As determined by the Indiana Department of Natural Resources (IDNR); or
        b) As calculated by a method and procedure which is acceptable to and approved by IDNR.
    4) If applicable, the 100-year storm event pool level of a reservoir:
        a) As determined by the Indiana Department of Natural Resources (IDNR); or
        b) As calculated by a method and procedure which is acceptable to and approved by IDNR.
    5) All pipes, tanks, secondary treatment device(s), and effluent distribution device(s).
    6) Requirements for trench onsite systems:
        a) All soil sample sites as shown on the written site evaluation report.
        b) Layout the proposed soil absorption field:
            i) Using a level or transit to insure that all laterals are laid out along the contour;
            ii) Marking the centerline of each trench; and
            iii) Using elevations and measurements, verify that no slope in the soil absorption field is greater than fifteen (15) percent;
    7) Requirements for sand mound onsite systems:
        a) All soil sample sites as shown on the written site evaluation report.
        b) Layout the proposed soil absorption field:
            i) Using a level or transit to insure that the aggregate bed and basal area are laid out along the contour;
            ii) Marking the perimeter of the aggregate bed and basal area; and
            iii) Using elevations and measurements, verify that no slope in the soil absorption field is greater than six (6) percent.
    8) If applicable, layout the proposed onsite system drainage system:
        a) Layout the surface diversion.
        b) Layout the subsurface drainage system and subsurface drain outlet location.
        c) Using elevations and measurements, verify that the surface diversion and subsurface drain can be installed maintaining at least minimum required grades.
c. Perform the following:
    1) Prepare a preliminary sketch of the site plan on a copy of the plat, with measurements, and preliminary design specifications, and submit to the local health department.

2) Coordinate with the local health department for a site visit and field verification of the layout of the onsite system, and review of the preliminary sketch of the site plan and preliminary design specifications.
3) If changes are necessary from:
    a) The preliminary sketch, prepare a final sketch of the site plan on a copy of the plat, with measurements, and submit to the local health department; and
    b) The preliminary design specifications, prepare final design specifications, and submit to the local health department.

# IV. Plan Submittal: Site Preparation, Cover, Finish Grading & Soil Stabilization

## A. General Requirements

1. The plan submittal must include written procedures for site preparation, if needed, finish grading and soil stabilization.
2. The design specification must:
    a. Require the verification of the location of underground utilities before site evaluation, site preparation and construction IC 8-1-26-1; and
    b. Specify that the site be staked out and protected from alteration or compaction prior to the start of any construction at the site, as required in *Chapter 6 Section I. A and Chapter 7 Section I. A*.
3. Site preparation, finish grading and soil stabilization must not be performed when the soil is sufficiently wet to exceed its plastic limit.
    a. Sufficient samples must be evaluated throughout the soil absorption field to assure that the plastic limit of the soil is not exceeded.
    b. The plastic limit of a soil is exceeded when the soil can be rolled between the palms of the hands to produce threads one-eighth (1/8) inch in diameter that do not easily break apart or crumble.
4. Site preparation, finish grading and soil stabilization must not be performed when the soil is frozen.
5. Site preparation, finish grading and soil stabilization must be performed in accordance with the approved plans.

## B. Site Preparation

1. For non-wooded soil absorption field sites with vegetation that can be cut with a mower or bush hog, the design specifications must include provisions that:
    a. Specify the type of equipment to be used; and
    b. Vegetation at the site be cut down with a mower or bush hog set at no higher than three (3) inches and excessive cut vegetation removed.
2. For wooded soil absorption field sites, the site plan and design specifications must comply with requirements of the department.
3. For soil absorption field sites on cultivated agricultural land, the design specifications must include provisions that:
    a. Specify the type of equipment to be used.
    b. Vegetation at the site be cut down with a bush hog set at no higher than three (3) inches and excessive cut vegetation removed.

c. If the written site evaluation report indicates compaction due to cultivation, the site must be tilled with a paratill™ plow.
    1) A soil scientist must identify the depth of compaction due to cultivation.
    2) Field operations must:
        a) Be performed to four (4) inches below the depth of compaction; and
        b) Not result in compaction of the soil at the site.

C. Cover, Finish Grading and Soil Stabilization

1. The plan submittal must comply with the requirements of *Chapter 5, Section XI, D*, *Chapter 6, Section I, B* for trench onsite systems, and *Chapter 7, Section I, A and F* for sand mound onsite systems.
2. The plan submittal must specify that cover, finish grading, seeding or sodding, and soil stabilization of the onsite system site occur as needed, and when site drainage requires, include a surface diversion on the upslope side of the soil absorption field.

## V. Plan Submittal: Additional Requirements for Experimental & Alternative Technology Onsite Systems

A. Preparation of the Plan Submittal

1. Authorized representatives of the manufacturer include manufacturer distributors and manufacturer representatives, defined as a manufacturer agent in *Chapter 8, Section II. B. 1.*
2. For residential experimental and alternative technology onsite systems, the plan submittal must:
    a. Be prepared and signed by a designer authorized by a manufacturer agent; or
    b. Certified by a professional engineer (P.E.) registered in Indiana, or architect registered in Indiana, authorized by a manufacturer agent.
3. For commercial facility experimental and alternative technology onsite systems, a P.E., or an architect registered in Indiana, authorized by a manufacturer agent, must certify the plan submittal.

B. A plan submittal containing experimental or alternative technology component(s) for a failed onsite system requiring a replacement soil absorption field must include:

1. The location of the failed soil absorption field; and
2. A description of the probable reasons for the failure as determined by the department or local health department, whichever has jurisdiction.

C. In the plan submittal, the owner, and designer or engineer, must comply with the requirements for operation and maintenance (O&M) contained in the *Chapter 8, Section II, Requirements for Operation and Maintenance*.

D. For experimental technology secondary treatment devices, the plan submittal must include the points of sampling for sampling and analysis of the septic tank and secondary treatment device required in *Chapter 8, Section IV. D. 1*.

## E. Additional Requirements for Experimental Soil Absorption Field Technology

1. The department may require a set-aside area in the plan submittal for onsite systems containing an experimental soil absorption field technology, as required in *410 IAC 6-8.2-53 (f), (g), and (h)*.
2. As part of the plan approval process, the designer and installer must lay out all onsite system components, the experimental soil absorption field technology, and set-aside soil absorption field on the site in compliance with the approved plans.
3. The plan submittal must also include:
    a. Site plans and cross-sections to scale.
    b. Date of the manufacturer's design and installation manual used for design of the experimental soil absorption field technology.
    c. Estimate of installation, monitoring and O&M costs.
    d. Experimental soil absorption field technology manufacturer and components supplier.

# Chapter 3 Site & Onsite System Requirements

Section I of this chapter addresses minimum separation distances for the location of the various components of an onsite system. Section II addresses requirements for the dispersal area. Section III addresses site requirements. Section IV addresses selection criteria for all trench onsite systems. Section V addresses selection criteria for sand mound onsite systems.

## I. Minimum Separation Distances

### A. Requirements

1. The location of tanks, soil absorption fields, and pipes must meet the minimum requirements of *Figure 3-1, Minimum Separation Distances* (see *Appendix A, Glossary* for definitions of pipes).
2. Pipe used in onsite systems must comply with *Figure 5-2, List of Acceptable Pipe*.
3. In *Sections I., B., C., D., and E.* of this chapter, the term "water lines and mains" includes lawn irrigation systems except when the lawn irrigation system is isolated from the potable water supply by a backflow prevention device that complies with *327 IAC 8-10, Cross Connection Control*.

### B. Standard Sewers: Parallel Separation Distances for Water Lines or Mains

1. The term "standard sewer" is used to describe gravity sewers, effluent sewers, effluent force mains, and sewage force mains manufactured of standard materials as described in *Figure 5-2, List of Acceptable Pipe*.
2. When water lines or mains, and standard sewers run parallel, the pipes must be:
   a. Separated by a horizontal distance of at least ten (10) feet edge-to-edge; or
   b. Separated by a minimum vertical distance of eighteen (18) inches between the bottom of the water line or main and the top of the standard sewer in separate trenches of undisturbed soil, with the water line or main in the upper trench; or
   c. Separated by a minimum vertical distance of eighteen (18) inches between the bottom of the water line or main and the top of the standard sewer on separate shelves of undisturbed soil, with the water line or main on the upper shelf.

### C. Upgraded Sewers: Parallel Separation Distances for Water Lines or Mains

1. The term "upgraded sewer" is used to describe gravity sewers, effluent sewers, effluent force mains and sewage force mains manufactured of upgraded materials as described in *Figure 5-2, List of Acceptable Pipe*.
2. When minimum separation distances required in *Section I. B. 2.* of this chapter are reduced, sewers must be:
   a. Upgraded pipe as described in *Figure 5-2, List of Acceptable Pipe*;
   b. Potable water pipe listed in *Figure 5-2, List of Acceptable Pipe*. When potable water pipe is used it must be clearly identified to distinguish it from a water line or main if similar or identical materials are used; or
   c. Waterworks grade ductile iron pipe with mechanical joints for all facilities regulated under *410 IAC 6-5.1, Sanitary Schoolhouse Rule*.

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**Figure 3-1**
**Minimum Separation Distances [1]**

| Location | Tanks & SAF [2] | Pipes [3] | |
|---|---|---|---|
| | | Standard | Upgraded [4] |
| Residential Well (including irrigation supply) & Residential Well Suction Water Lines [5] | 50 ft.[6] | 50 ft.[6] | 20 ft.[7] |
| Commercial Well (including irrigation supply) & Commercial Well Suction Water Lines | 100 ft. | 100 ft. | 50 ft. |
| Abandoned Well [8] | 50 ft. | 50 ft. | 20 ft. |
| Community Public Water Supply (PWS) | 200 ft. | 200 ft. | 70 ft. |
| Non-Community Public Water Supply (PWS) | 100 ft. | 100 ft. | 50 ft. |
| Water Lines and Mains [9] | 10 ft. | 10 ft. | – |
| Lake, Pond, Detention Pond, or Reservoir [10] | 50 ft. | – | – |
| Detention Basin [11] or Retention Facility [12] | 25 ft. | – | – |
| River, Stream, Creek, or Ditch [10] | 25 ft | – | – |
| Property Lines & Road Right-of-Ways [13] | 5 ft. | 5 ft. | 5 ft. |
| Structures, (structures must also maintain separation distances contained in *Figure 3-2, Dispersal Area Width for Soil Absorption Fields in Soils with a SLR ≤ 0.5 gpd/ft²).* | 10 ft. | – | – |
| Slope > 15% | 10 ft. | – | – |

[1] Separation distances are horizontal.

[2] SAF means soil absorption field. For the purpose of minimum separation distances, measured from the following:

- For trench onsite systems, the outside edge of the outermost soil absorption trenches parallel to the length of the trenches and the ends of all trenches; and
- For sand mound onsite systems, the outside edge of the Spec. 23 sand.

[3] See glossary for definitions of gravity sewer, effluent sewer, effluent force main, sewage force main, manifold, gravity distribution lateral & pressure distribution lateral.

[4] Upgraded pipe, listed in *Figure 5-2, List of Acceptable Pipe*, must be used for shorter separation distances to be permitted.

[5] Both before and after installation and construction of the onsite system.

[6] Commercial facility onsite systems must be located at least 100 ft. from residential wells.

[7] May be reduced to 10 ft. for drilled or driven wells.

[8] The separation distance may be reduced to 10 ft. for any abandoned well plugged according to *312 IAC 13-10-2(c)*.

[9] Water lines and mains: includes lawn irrigation systems.

[10] Normal high water mark.

[11] Detention basin (see definition): area designated on a subdivision plat plan.

[12] Retention facility (see definition): pool area designated on a subdivision plat plan for a 100-year storm event.

[13] Unless an easement is obtained, separation distances must also comply with the requirements for dispersal areas, *Figure 3-2, Dispersal Area Width for Soil Absorption Fields in Soils with a SLR ≤ 0.5 gpd/ft².*

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### D. Standard Sewers: Crossings of Water Mains and Lines

1. The term "standard sewer" is used to describe gravity sewers, effluent sewers, effluent force mains and sewage force mains manufactured of standard materials as described in *Figure 5-2, List of Acceptable Pipe*.
2. When any portion of a standard sewer crosses a water line or main, the pipes must be separated by eighteen (18) vertical inches.

### E. Upgraded Sewers: Crossings of Water Mains and Lines

1. The term "upgraded sewer" is used to describe gravity sewers, effluent sewers, effluent force mains and sewage force mains manufactured of upgraded materials as described in *Figure 5-2, List of Acceptable Pipe*.
2. When a minimum separation distance of 18 vertical inches required in *Section I. D. 2.* of this chapter is reduced, the length of the sewer (ten) 10 feet on either side of the water main must be:
   a. Upgraded pipe as described in *Figure 5-2, List of Acceptable Pipe*;
   b. Potable water pipe listed in *Figure 5-2, List of Acceptable Pipe*. When potable water pipe is used it must be clearly identified to distinguish it from a water line or main if similar or identical materials are used; or
   c. Waterworks grade ductile iron pipe with mechanical joints for all facilities regulated under *410 IAC 6-5.1, Sanitary Schoolhouse Rule*.
3. When an upgraded sewer, crosses over a water line or main, structural support must be provided for the upgraded sewer to maintain line, grade, and pipe integrity.
4. Upgraded sewer joints must be as far as possible from the water main joints.

### F. Sewers: Crossing an Onsite System Subsurface Drain

1. The term "sewer" is used to describe gravity sewers, effluent sewers, effluent force mains, and manifolds manufactured of standard and upgraded materials as described in *Figure 5-2, List of Acceptable Pipe*.
2. Requirements for sewers crossing an onsite system subsurface drain trench.
   a. Joints must be as far as possible from the subsurface drain trench.
   b. Joints and connections must not be within four (4) horizontal feet of the centerline of the subsurface drainpipe.
3. Where the sewer crosses the onsite system subsurface drain trench, the backfill must meet the requirements of *Chapter 4, Section II. F., Onsite System Subsurface Drain Trenches & Drainpipes*.

## II. Dispersal Area Requirements

The purpose of a dispersal area is to assure sufficient space for subsurface water to flow away from the soil absorption field.

### A. Requirements

1. A dispersal area is required for soil absorption fields when:
   a. The soil loading rate used to determine the size of the soil absorption field is five-tenths (0.5) gallons per day per square foot (gpd/ft$^2$) or less; or

b. There is a horizon in the upper sixty-six (66) inches of the profile description with a soil loading rate of less than twenty-five hundredths (0.25) gallons per day per square foot (gpd/ft$^2$).

2. When a dispersal area is required, the following requirements must be met.
   a. For soil absorption fields with a slope of one-half (1/2) percent or less, a dispersal area as described in *Figure 3-2, Dispersal Area Width for Soil Absorption Fields in Soils with a Soil Loading Rate (SLR) ≤ 0.5 gpd/ft$^2$* must be maintained:
      1) On each side of the outside edge of the outer trench parallel to the length of the trench; or
      2) On each side of the outside edge of the Spec. 23 sand and parallel to the long axis of the sand mound.
   b. For soil absorption fields with a slope of greater than one-half (1/2) percent, a dispersal area as described in *Figure 3-2, Dispersal Area Width for Soil Absorption Fields in with a Soils Loading Rate (SLR) ≤ 0.5 gpd/ft$^2$* must be maintained on the downslope side of the soil absorption field:
      1) From the outside edge of the downslope trench parallel to the length of the trench; or
      2) From the outside edge of the Spec. 23 sand downslope and parallel to the long axis of the sand mound.
3. Compaction of the dispersal area must not result in dense materials.

**Figure 3-2**
**Dispersal Area[1] Width for Soil Absorption Fields in Soils with a Soil Loading Rate (SLR) ≤ 0.5 gpd/ft$^2$**

| | |
|---|---|
| Slope ≤ 1/2 %:[2]<br>Onsite system w/o perimeter drain | 1/4 width of soil absorption field[5] |
| Slope > 1/2 %:[3]<br>Onsite system w/o perimeter drain | 1/2 width of soil absorption field[5] |
| Any Slope:<br>Onsite system w/ perimeter drain[4] | 10 ft. |

[1] No structures are allowed in the dispersal area.

[2] Dispersal area is located on each side of the outside edge of the outer trench parallel to the length of the trench, or on each side of the outside edge of the basal area and parallel to the long axis of a sand mound, and must not be on slopes > 15%.

[3] Dispersal area is located on the downslope side of the soil absorption field and must not be on slopes > 15%.

[4] For onsite systems with a subsurface perimeter drain without a seasonal high water table, the design and installation of the drain must meet the requirements of *Chapter 4, Section II*.

[5] Dispersal area width must not be less than 10'. A dispersal area width of more than 25' is not required.

B. Requirements for Location

1. A dispersal area must be located on the property or adjoining property with easement.
2. No structures are allowed in a dispersal area (see definition for structure in *Appendix A, Glossary*).
3. Dispersal areas must not be located in closed depressions where surface runoff or subsurface water movement will have an adverse affect on onsite system performance, in potholes, or in areas subject to ponding.
4. Dispersal areas must not be located on, or contain, slopes greater than fifteen (15) percent.
5. For soil absorption fields with a slope of greater than one-half (1/2) percent, no part of the dispersal area may slope toward the soil absorption field.

## III. Site Requirements for Onsite Systems

All of the following provisions must be met to permit the installation and construction of an onsite system.

A. Sufficient area must exist on the property or another property with easement for an onsite system sized in accordance with this document with required separation and setback distances. See *410 IAC 6-8.2-43(m)* for requirements for a recorded easement or other legally executed document when any portion of the onsite system is located on property other than that from which sewage originates. See also *Sections I. and II.* of this chapter and *Chapter 5, Section XI. A., Size of Soil Infiltrative Surface.*

B. Tanks and soil absorption fields must be located outside drainageways and swales.

C. Soil absorption fields must not be located where surface or subsurface waters will converge downslope causing water flow to become concentrated or restricted within the soil absorption field or dispersal area.

D. Onsite system sites must not be located where surface runoff or subsurface water movement cannot be effectively diverted away from the onsite system (see *Chapter 4*).

E. Tanks and soil absorption fields must not be located in designated wetlands, in closed depressions where surface runoff or subsurface water movement will have an adverse affect on onsite system performance, in potholes, or in areas subject to ponding.

F. When hydric soils are identified in the written site evaluation report (see *Chapter 2, Section II. B. 2.*), the local health department or department may require a wetland delineation study.

## IV. Trench Onsite System Selection Criteria

Four types of “trench” soil absorption fields may be considered. These include gravity, alternating field, flood dose, and trench pressure. All trench onsite systems approved for construction under this technical specification use aggregate filled trenches or aggregate-free chambers.

In gravity onsite systems, effluent flows by gravity. Flood dose onsite systems use a dose tank downstream of the septic tank, in which effluent is collected and then pumped to a distribution box where it then flows by gravity to the soil absorption field. Flood dose onsite systems may be considered where: the soil absorption trenches are at a higher elevation than the septic tank; the soil absorption field size requires dosing; or, the site or soil conditions do not permit gravity onsite systems.

An alternating field onsite system may be used instead of a flood dose onsite system for residential onsite systems only. Alternating field onsite systems are comprised of two gravity soil absorption fields with a diverter device located in the effluent pipe before splitting to the distribution boxes serving each field. The diverter valve or device allows the effluent to be directed to one field or the other, and is switched no less than annually. Each gravity soil absorption field in an alternating field onsite system must be sized according to the design daily flow (DDF) required in *Chapter 5, Section I*.

Trench pressure onsite systems use a dose tank downstream of the septic tank in which the effluent is collected and then pumped to the soil absorption trenches under pressure, thereby providing uniform distribution of effluent. Trench pressure onsite systems may be considered in situations where: soils are unsuited for other types of trench onsite systems; absorption trenches are at a higher elevation than the septic tank; or, where site conditions require trenches of different lengths.

The design of trench soil absorption fields is addressed in *Chapter 6*. The design of trench pressure onsite system is complex; additional design issues related to the pressure distribution network and pump size are addressed in *Chapter 5*. Refer to *Appendix C, Figure 3-4, Soil Loading Rates* used in determining soil absorption field size (see *Chapter 5, Section XI. A*.

## A. Site Requirements for All Trench Onsite Systems

The following site conditions must be met for each of the various trench onsite systems.

1. Sufficient area must exist on the property or property with easement for an onsite system sized in accordance with this document with required separation and setback distances. See *410 IAC 6-8.2-43(m)* for requirements for a recorded easement or other legally executed document when any portion of the onsite system is located on property other than that from which sewage originates; see also *Sections I. and II.* of this chapter and *Chapter 5, Section I.* and *Section XI. A*.
2. Requirements for regulatory (base) flood elevation.
    a. For onsite systems serving residences and regulated commercial facilities, trench bottoms must be above the regulatory (base) flood elevation.
    b. For other commercial facilities, the original grade of the soil absorption field must be above the regulatory (base) flood elevation.
3. The soil absorption field site must contain no slope greater than fifteen (15) percent.
4. The topography of the soil absorption field site must be linear or convex.

5. If surface diversions and subsurface drains can divert surface and subsurface water around the soil absorption field, a footslope or toeslope position may be considered.
6. Any seasonal high water table at the soil absorption field site must be lowered to at least twenty-four (24) inches below the bottom of each trench in the soil absorption field (see *Chapter 4, Site Drainage*).
7. Requirements for soil absorption fields.
    a. The site must be suitable for the installation of trenches at least ten (10) inches into soil.
    b. The site must be suitable for the installation of trenches at least ten (10) inches into the soil underlying fill.
    c. The site must be suitable for the installation of trench bottoms no more than thirty-six (36) inches below final grade [see *Chapter 6, Section I. D. 2. e. 4)*].
    d. Disturbance or alteration of the soil absorption field or dispersal area site must not result in densic materials.

### B. Gravity Onsite System Selection Criteria

In addition to the onsite system site requirements of *Sections III. and IV. A.* of this chapter, the soil absorption field site must meet the following requirement:

The soil loading rate of all soil horizons in the first thirty (30) inches below each trench bottom is no less than twenty-five hundredths (0.25) and no more than seventy-five hundredths (0.75) gallons per day per square foot.

### C. Flood Dose & Alternating Field Onsite System Selection Criteria

In addition to the onsite system site requirements of *Sections III. and IV. A.* of this chapter, flood dose soil absorption field sites, and both soil absorption field sites for alternating field onsite systems, must meet the following requirement:

The soil loading rate of all soil horizons in the first twenty-four (24) inches below each trench bottom is no less than twenty-five hundredths (0.25) and no more than seventy-five hundredths (0.75) gallons per day per square foot.

### D. Trench Pressure Onsite System Selection Criteria

In addition to the onsite system site requirements of *Section III. and IV. A.* of this chapter, the soil absorption field site must meet the following requirement:

The soil loading rate of all soil horizons in the first twenty-four (24) inches below each trench bottom is no less than twenty-five hundredths (0.25) and no more than one and twenty hundredths (1.20) gallons per day per square foot.

## V. Sand Mound Onsite System Selection Criteria

In sand mound onsite systems the effluent is delivered from a dose tank to a pressure distribution network installed in an aggregate bed constructed within a bed of sand. A sand mound onsite system may be an option where the site is unsuited for a trench onsite system.

The design of sand mound onsite systems is addressed in *Chapter 7*. The design of pressure distribution networks is addressed in *Chapter 5*. Refer to *Appendix C, Figure 3-4, Soil Loading Rates*.

### A. Site Requirements for Sand Mound Onsite Systems

The following site conditions must be met for sand mound onsite systems.

1. Sufficient area must exist on the property or another property with easement for an onsite system sized in accordance with this document with required separation and setback distances. See *410 IAC 6-8.2-43(m)* for requirements for a recorded easement or other legally executed document when any portion of the onsite system is located on property other than that from which sewage originates; see also *Sections I. and II.* of this chapter and *Chapter 5, Section I.* and *Section XI. A.*
2. The soil surface must be above the regulatory (base) flood elevation.
3. The soil absorption field site must have no slope greater than six (6) percent.
4. The topography of the soil absorption field site must be linear or convex.
5. If surface diversions and subsurface drains can divert surface and subsurface water around the soil absorption fields, a footslope or toeslope position may be considered.
6. Any seasonal high water table at the soil absorption field site must be lowered to at least twenty (20) inches below the original grade of the soil absorption field (see *Chapter 4, Site Drainage*).
7. Compaction of the soil absorption field or dispersal area site must not result in densic materials.
8. For soil absorption field sites with fill material, removal of the fill material may be an option provided that:
   a. A depression is not created.
   b. Disturbance or alteration of the soil absorption field or dispersal area site must not result in densic materials during the original placement of the fill and the fill removal operations.
   c. A new site evaluation, after removal of the fill, is submitted to the local health department or department.

### B. Sand Mound Onsite System Selection Criteria

In addition to the onsite system site requirements of *Section III. and V. A.* of this chapter, the soil absorption field site must meet the following requirement:

The soil loading rate of all soil horizons in the first twenty (20) inches below the original grade of the soil absorption site is no less than twenty-five hundredths (0.25) and no more than one and twenty-hundredths (1.20) gallons per day per square foot.

## VI. Requirements, Secondary Treatment for Nitrogen Reduction

*IC 13-18-17-5* requires state agencies to apply groundwater quality standards established under *327 IAC 2-11-1*, et. seq., to assure that groundwater quality criteria enumerated in that rule are not exceeded. The requirements of this section

for secondary treatment of sewage effluent prior to discharge to a soil absorption field protect groundwater.

A. When the provisions of Section VI. B. and C. of this chapter require secondary treatment for nitrogen reduction, the effluent quality from a secondary treatment device must not average more than 10 mg/l.

B. Analysis of County Soil Survey Report Data

1. The site of the proposed onsite system must be located on the soil survey atlas sheet of the county soil survey report.
2. Soil map unit(s) that are contained within the boundaries of the proposed soil absorption field site must be identified and recorded on the written site evaluation report.
3. The identified soil map unit(s) must be compared with the *Soil Map Units with a Nitrate Leaching Index Greater Than Ten*, as published periodically by the department from the *Nitrate Leaching Index Table*, U.S.D.A.-Natural Resources Conservation Service (NRCS).
4. If none of the identified soil map units are on the *Soil Map Units with a Nitrate Leaching Index Greater Than Ten*, *s*econdary treatment is not required.
5. If any of the identified soil map units are on the *Soil Map Units with a Nitrate Leaching Index Greater Than Ten,* the analysis of *Section VI. B* of this chapter is required.

C. Analysis of Data on the Written Soil Profile Report

1. Secondary treatment for nitrogen reduction is required if:
   a. A layer with a soil loading rate of less than twenty-five hundredths (0.25) gallons per day per square foot ($gpd/ft^2$) is not located below the soil absorption field; and
   b. Any of the B, C, and R soil horizons to a depth of eighty (80) inches from existing grade:
      1) Contain very coarse sand (VCOS), loamy very coarse sand (LVCOS), coarse sand (COS), medium sand (S), loamy coarse sand (LCOS), fine sand (FS), very fine sand (VFS), loamy sand (LS), loamy fine sand (LFS), or loamy very fine sand (LVFS); or
      2) Contain more than thirty-five (35) percent coarse fragments by volume, bedrock, marl, muck, ortstein, or peat.
2. Secondary treatment for nitrogen reduction is not required if:
   a. A layer with a soil loading rate of less than twenty-five hundredths (0.25) gallons per day per square foot ($gpd/ft^2$) is located below the soil absorption field; or
   b. The conditions of *Section VI, B. 1. b.* of this chapter do not exist; or
   c. The property has all of the following characteristics:
      1) It is more than ten (10) acres;
      2) The soil absorption field is more than three hundred (300) feet from any property line; and
      3) All water supply wells are located at least three hundred (300) feet from the soil absorption field.

3. Requirements for secondary treatment devices are contained in *Chapter 8, Section III, Secondary Treatment Devices*.

# Chapter 4 Site Drainage

A surface diversion is used to direct surface runoff away from a soil absorption field. An onsite subsurface drainage system (interceptor, perimeter, segment drain, and main drain) is used to divert subsurface water away from a soil absorption field by lowering a seasonal high water table.

## I. Surface Diversions

A. A surface diversion is required if drainage from an adjoining upslope landscape affects the soil absorption field site.

B. A surface diversion must have a positive grade of at least two and four-tenths (2.4) inches per one hundred (100) feet (a grade of 0.2%).

C. A surface diversion must be of sufficient depth and width to move surface water away from the soil absorption field.

D. A surface diversion may be used in combination with an onsite subsurface drainage system perimeter or interceptor drain.

## II. Onsite Subsurface Drainage Systems

There are four components that may be used in an onsite subsurface drainage system to lower the seasonal high water table: perimeter drain, interceptor drain, segment drain(s) and main drain. The onsite subsurface drainage system allows water to flow by gravity through a drainpipe with a positive grade, and discharge either into an existing subsurface drain or to the ground surface.

### A. Requirements for an Onsite Subsurface Drainage System

1. An onsite subsurface drainage system is required for trench onsite systems when the seasonal high water table at the soil absorption field site is within twenty-four (24) inches of the bottom of any trench in the soil absorption field (see *Chapter 3, Section IV. A .6.*).
2. An onsite subsurface drainage system is required for sand mound onsite systems when the seasonal high water table at the soil absorption field site is within twenty (20) inches of the original grade of the soil absorption field site (see *Chapter 3, Section V. A. 6.*).
3. An onsite subsurface drainage system must be designed and installed to permit water to flow by gravity to an outlet. Pumps or siphons cannot be used to effect the movement of collected water for drainage.
4. If any portion of the onsite subsurface drainage system, up to the point of entry into a regulated subsurface drain or to the point of surface discharge, is located on property other than that on which the onsite system is installed, a recorded easement or other recorded legally executed document must be obtained from all property owners for installation and access for maintenance.
5. Components of an onsite subsurface drainage system.
   a. A perimeter drain must be installed around all commercial facility soil absorption fields (*see Appendix A, Glossary*, for definition of soil absorption field).

b. For residential onsite systems:
    1) A perimeter drain must be installed around a soil absorption field (*see Appendix A, Glossary*, for definition of soil absorption field) when the following conditions are encountered:
        a) The slope of the soil absorption field site is six (6) percent or less; or
        b) The slope of the soil absorption field site is greater than six (6) percent and the drain is not installed into massive clay, till, fragipan or soil with a loading rate (SLR) of less than twenty five hundredths (0.25) gallons per day per square foot.
    2) An interceptor drain may be installed (instead of a perimeter drain) upslope of a soil absorption field when the following conditions are encountered:
        a) The slope of the soil absorption field site is greater than six (6) percent; and
        b) The drain is installed at least two (2) inches into massive clay, till, fragipan or soil with a loading rate (SLR) of less than twenty five hundredths (0.25) gallons per day per square foot.
c. A segment drain may be installed between trenches and sand mounds, in conjunction with:
    1) A perimeter drain, provided the requirements of *Section I. A. 5. b. 1)* of this chapter are met.
    2) An interceptor drain, provided the requirements of *Section I. A. 5. b. 2)* of this chapter are met.
d. A main drain must be connected to a perimeter drain, or interceptor drain (and segment drain, if installed), to outlet the onsite subsurface drainage system.

## B. Depth of Onsite Subsurface Drainage System

1. The onsite subsurface drainage system must meet one of the following requirements:
    a. Perimeter, interceptor, and segment drains must be installed at least two (2) inches into massive clay, till, fragipan, or a soil with a soil loading rate (SLR) of less than twenty-five hundredths (0.25) gallons per day per square foot; or
    b. Perimeter and segment drains must be installed sufficiently deep to lower the seasonal high water table to the depth required in *Chapter 3, Section IV. A. 6* and *Chapter 3, Section V. A. 6*.
        1) For residential onsite system lots platted before and up to one (1) year after the effective date of *410 IAC 6-8.2,* and if the requirement in *Section II. B. 1. a.* of this chapter is not possible, the subsurface perimeter or segment drain must be sufficiently deep to lower the seasonal high water table to the required depth below the soil absorption field. The onsite subsurface drainage system depth must be determined by a method acceptable to the local health department.
        2) For residential onsite system lots platted more than one (1) year after the effective date of *410 IAC 6-8.2,* and for all commercial onsite systems, and if the requirement of *Section II. B. 1. a*. of this chapter is not possible, one of the following requirements must be met:

a) The depth of the drain must be determined through calculations made using accepted engineering methods or models.
   i) The owner or agent must submit verification that the subsurface drainage system will lower the seasonal high water table to the depth required in *Chapter 3, Section IV. A. 6 and Chapter 3, Section V. A. 6,* whichever is applicable.
   ii) The owner or agent must provide the drainage formula used, as well as calculations, for verification; or
b) The depth of the drain must be the following:
   i) For trench onsite systems, the invert elevation of the drainpipe of the subsurface perimeter drain or segment drain must be at least thirty-six (36) inches below the elevation of any adjacent soil absorption trench bottom; and
   ii) For sand mound onsite systems, the invert elevation of the drainpipe of the subsurface perimeter drain or segment drain must be at least thirty-two (32) inches below existing grade.

2. When a subsurface perimeter drain or segment drain is installed solely to reduce the size of the dispersal area required in *Figure 3-2, Dispersal Area Width for Soil Absorption Fields in Soils with an SLR $\leq$ 0.5 gpd/ft$^2$*, it must meet the depth requirements of *Section II. B. 1. a. or b.* of this chapter.
3. The onsite subsurface perimeter drain system must be installed no deeper than sixty (60) inches below existing grade.

## C. Location of Onsite Subsurface Drainage System

1. All portions of an onsite subsurface drainage system must be installed at least ten (10) feet from the outside edge of any soil absorption trench.
2. All portions of an onsite subsurface drainage system must be installed at least ten (10) feet from the outside edge of the INDOT Specification 23 sand in a sand mound onsite system.
3. Spacing of subsurface perimeter drains and segment drains installed parallel to the long axis of soil absorption fields must be no more than sixty-five (65) feet apart, unless the separation distance of the drains is determined through calculations made using accepted engineering methods or models.
4. An interceptor drain, parallel to the upslope edge of the soil absorption field, must:
   a. Comply with the requirements of *Section II. C. 1. and 2.* of this chapter and be no greater than twenty-five (25) feet from the soil absorption field;
   b. Extend ten (10) feet beyond each end of the upslope trench, or to the property line, whichever is less, for trench onsite sewage systems; and
   c. Extend ten (10) feet beyond the outside edge of the upslope side of the INDOT Specification 23 sand, or to the property line, whichever is less, for sand mound onsite sewage systems.

## D. Outlet of an Onsite Subsurface Drainage System

1. When the main drain outlets to a body of water, the invert elevation of the main drainpipe outlet must be at least six (6) inches above the normal flow line of the receiving body of water.
2. When the main drain outlets into an existing subsurface drain:

a. The existing subsurface drain must be at a sufficient depth to meet the depth requirements of *Section II. B.* of this chapter;
b. The existing subsurface drain must be active and allow for the free flow of water; and
c. When the existing subsurface drain outlets to a body of water, the invert elevation of the outlet must be at least six (6) inches above the normal flow line of the receiving body of water.

## E. Requirements for Onsite Subsurface Drainage System Trenches & Drainpipes

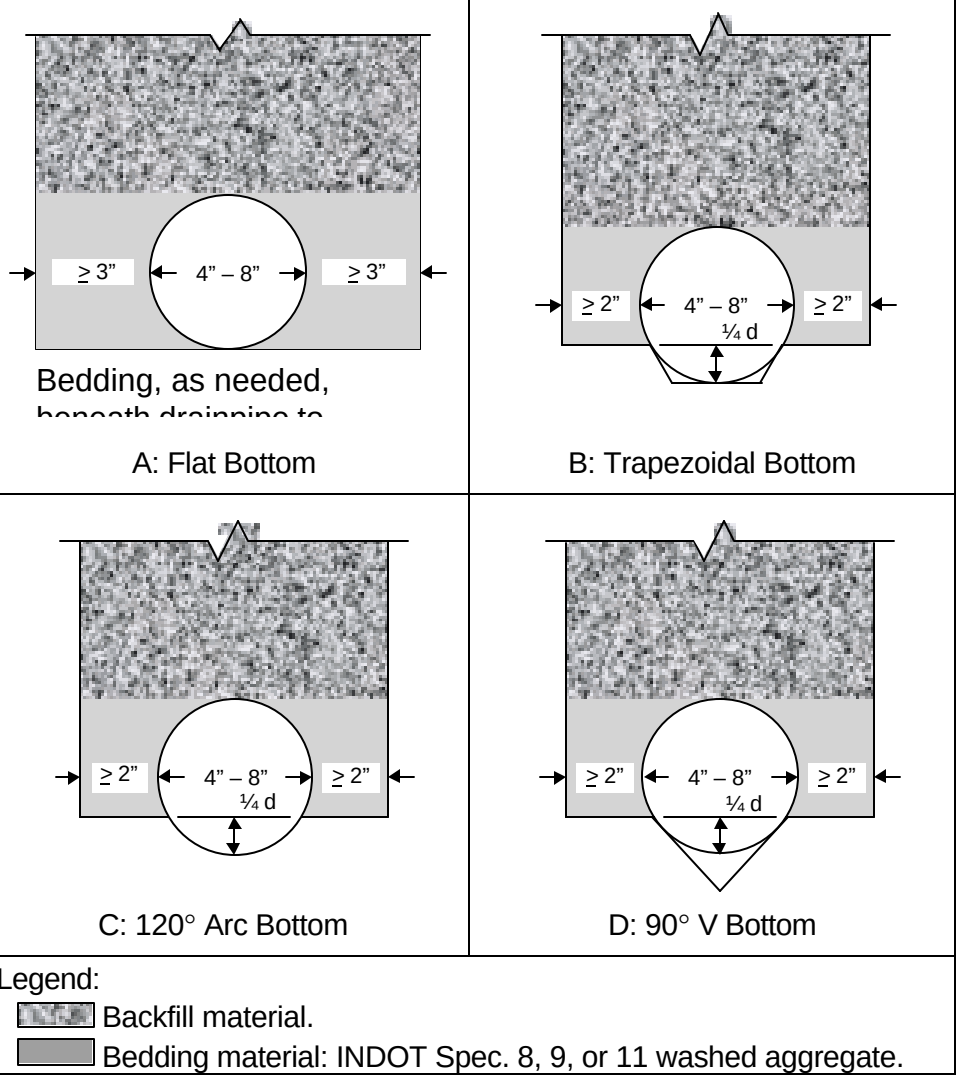
1. Onsite subsurface drainage system trenches must meet the requirements of *ASTM F 449* and *Natural Resources Conservation Service Field Office Technical Guide Conservation Practice Standard 606*, except as noted in this document.
2. Onsite subsurface perimeter drain trenches must be installed no deeper than sixty (60) inches below existing grade.
3. Onsite subsurface drainage system trenches must be installed as shown in *Figure 4-1, Drain Trench Cross Sections*, with:
   a. A flat bottom; or
   b. A grooved bottom.
      1) The groove in the trench bottom must be:
         a) Trapezoidal; or
         b) A one-hundred and twenty (120) degree arc; or
         c) A ninety (90) degree V.
      2) The bottom quarter of the pipe must be below the contact points of the groove.
4. Drain trenches and drainpipe must have a positive grade of at least:
   a. Two and four-tenths (2.4) inches per one-hundred (100) feet for four (4) inch diameter drainpipe (a grade of 0.2 %); or
   b. One and two tenths (1.2) inches per one hundred (100) feet for five (5) inch diameter drainpipe or greater (a grade of 0.1 %).
5. Requirements for installation of onsite subsurface drainage system trenches and drainpipe.
   a. Installation of an onsite subsurface drainage system must begin from the outlet of the main drain.
   b. Survey equipment must be used to insure continuous positive grade along the flat trench bottom or grooved shaped trench bottom.
   c. For drain trenches installed according to *Figure 4-1, A, Drain Trench Cross Sections*, backhoe equipment or an agricultural tiling machine must be used.
      1) Loose soil must be removed from the bottom of the trench to prevent settling of the drainpipe.
      2) Bedding material, as needed, must be placed over the trench bottom to insure continuous positive grades required in *Section II. E. 4.* of this chapter.
      3) Rigid drainpipe, as specified in *Figured 5-2, List of Acceptable Pipe*, must be installed in the center of the trench, holding the drainpipe in

place and adding bedding material, as required in *Section II. E. 6.*, to anchor the drainpipe.

4) Bedding material must be added to the trench and around the drainpipe according to *Figure 4-1, A, Drain Trench Cross Sections*.

5) The trench must be backfilled as required in *Section II. E. 7.* of this chapter.

**Figure 4-1**
**Drain Trench Cross Sections**




A: Flat Bottom

B: Trapezoidal Bottom

C: 120° Arc Bottom

D: 90° V Bottom

Legend:
Backfill material.
Bedding material: INDOT Spec. 8, 9, or 11 washed aggregate.

d. For drain trenches installed according to *Figure 4-1, B, C, or D, Drain Trench Cross Sections*, an agricultural tiling machine must be used.

1) Loose soil must be removed from the bottom of the trench and trench groove to prevent settling of the drainpipe.

2) Flexible drainpipe, as specified in *Figured 5-2, List of Acceptable Pipe*, must be installed in the groove of the trench, holding the drainpipe in place and adding bedding material, as required in *Section II. E. 6.*, to anchor the drainpipe.

3) Bedding material must be added to the trench and around the drainpipe according to *Figure 4-1, B, C and D, Drain Trench Cross Sections*, whichever is applicable.
4) The trench must be backfilled as required in *Section II. E. 7.* of this chapter.

e. Open ends of drainpipes, excluding the main drain, must be capped.

6. Bedding material must be:
   a. Indiana Department of Transportation Standard Specifications 8, 9, or 11 (*INDOT Spec. 8, 9, or 11*) aggregate.
   b. Used to support and protect onsite subsurface drainage system drainpipe.
      1) In flat bottom trenches:
         a) Bedding material, as needed, must be placed over the trench bottom to insure continuous positive grades required in *Section II. E. 3.* of this chapter.
         b) A minimum of three (3) inches of bedding material must be placed on both sides of the drainpipe, as shown in *Figure 4-1, A, Drain Trench Cross Sections*.
      2) In groove bottom trenches, a minimum of two (2) inches of bedding material must be installed on both sides of the drainpipe, as shown in *Figure 4-1, B, C, or D, Drain Trench Cross Sections*. When the bottom of the drainpipe is in contact with sand, loamy sand, sandy loam, fine sandy loam, loam, silt loam, or silt, it must be wrapped with a geotextile fabric that meets the requirements of *Chapter 5, Section X. A. 1.*
7. The material used for backfill of perimeter, interceptor, and segment drain trenches must be:
   a. Filled to finish grade with washed *INDOT Spec. 2, 5, 8, or 11* aggregate, or equivalent; or
   b. Filled to within six (6) inches of finish grade with washed *INDOT Spec. 2, 5, 8, or 11* aggregate, or equivalent and the final six (6) inches to finish grade with cover soil material.

### F. Requirements for Onsite Subsurface Drainage System Main Drain & Outlets

1. Main drain trenches and drainpipe must be installed according to the requirements in *Section II, E. 1. through 7.* of this chapter.
2. Subsurface drainpipe used for main drains must not be perforated.
3. Soil material must be used to backfill trenches to final grade.
4. At least ten (10) feet of the drainpipe, at the surface outlet of the main drain, must:
   a. Meet the minimum pipe specification for gravity sewers; and
   b. Be fitted with a non-corrosive rodent guard.
5. The soil around the main drain surface outlet must be protected from erosion.

## III. Disruption of Existing Subsurface Drainpipes

A. The flow from existing subsurface drainpipes must not cross a soil absorption field.

B. Existing subsurface drainpipes must be:

1. Routed around a soil absorption field;
2. Connected to a non-onsite subsurface drainage system drain; or
3. Connected to a main drain sized to handle all flows.

C. Segments of abandoned subsurface drainpipes remaining in a soil absorption field must be plugged at all exposed ends to prevent water movement.

# Chapter 5 General Onsite System Components

Requirements for general onsite system components are described in this chapter. General onsite system components are onsite system components common to two or more types of onsite systems. Requirements unique to each onsite system are covered in *Chapters 6 & 7*.

## I. Design Daily Flow (DDF) of Sewage

### A. Residences

1. Design daily flow (DDF) for residences must be calculated as one-hundred and fifty (150) gallons per day (gpd) times the sum of the number of bedrooms plus the number of bathtubs and jetted tubs with capacities greater than or equal to one-hundred and twenty-five (125) gallons [DDF = 150 gpd x (no. of bedrooms + no. of bathtubs $\geq$ 125 gal. + no. of jetted tubs $\geq$ 125 gal.)].
2. DDF for residential outbuildings (see *Appendix A, Glossary* for definition) must be calculated as:
   a. Zero (0) gallons per day (gpd) for outbuildings connected to an existing onsite system.
   b. One-hundred and fifty (150) gallons per day (gpd) for outbuildings connected to a separate onsite system, or as required by local ordinance, whichever is greater.

### B. Commercial Facilities

1. Design daily flow (DDF) for commercial facilities must be calculated from *Appendix C, Figure 5-1, Standards for Calculating Sewage Flows for Commercial Facilities*.
   a. DDF for commercial facilities must be calculated as no less than one-hundred and fifty (150) gallons per day (gpd).
   b. The department must be contacted to determine DDF for commercial facilities not listed in *Appendix C, Figure 5-1, Standards for Calculating Sewage Flows for Commercial Facilities.*
2. A reduction in the DDF for commercial facilities calculated from *Appendix C, Figure 5-1, Standards for Calculating Sewage Flows for Commercial Facilities* will be considered only if:
   a. Evidence (such as daily water meter readings) is presented with the application demonstrating that smaller flows will occur; or
   b. DDF data for similar facilities in similar surroundings is presented with the application.

## II. Pipes

### A. General

Pipes used in onsite system include gravity sewers, effluent sewers, sewage and effluent force mains, manifolds, gravity distribution laterals, pressure distribution laterals, and drainpipe, and are listed in *Figure 5-2, List of Acceptable Pipe*.

## Figure 5-2
## List of Acceptable Pipe[1]

**I. Gravity Sewer & Effluent Sewer:**

***1. Standard***

a. PVC ASTM D 2665 for 4-inch and 6-inch pipe.
   ASTM F 891 SDR 35 for 4-inch through 8-inch cellular core pipe with minimum pipe stiffness of 50 (PS 50).
   ASTM D 3034 SDR 26 and 35 for 4-inch through 15-inch pipe.

b. ABS ASTM D 2661 4-inch and 6-inch pipe.
   ASTM D 2680 8-inch through 15-inch pipe.
   ASTM D 2751 SDR 23.5 or SDR 35 for 4-inch and 6-inch pipe.

c. Waterworks grade ductile iron pipe with mechanical or tyton joints.

***2. Upgraded***

a. PVC ASTM D 3034 SDR 21 or 26 or ASTM D 2241 SDR 13.5, 17, 21, or 26 with gasket compression-type joints for 4-inch through 8-inch pipe.

b. ABS ASTM D 2751 SDR 23.5 for 4-inch and 6-inch pipe.

c. Waterworks grade ductile iron pipe with mechanical joints.

**II. Force Main, Manifolds & Pressure Distribution Laterals:**

***1. Standard***

PVC ASTM D 1785 Schedule 40, 80, or 120 at least 1-inch in diameter.

***2. Upgraded***

Any PVC or ABS pipe (at least 1-inch in diameter) listed for potable water with compression gasket joints.

**III. Gravity Distribution Laterals**

a. Gravity sewer and effluent sewer pipe (4-inches in diameter) listed above.

b. Potable water pipe (4-inches in diameter) listed below.

c. PVC ASTM D 2729 for 4-inch pipe.

d. Polyethylene ASTM F 810 or AASHTO M252 Type SP for 4-inch pipe.

**IV. Drainpipe**

AASHTO M252 for 4-inch through 8-inch pipe.
PVC ASTM D 3034 SDR 35.

**V. Potable Water Pipe**

Pipe must have the National Sanitation Foundation (NSF) seal for potable water and be rated to withstand the applied pressure. Solvent weld fittings are not acceptable.

**1. Diameters less than 1 1/2-inch:**

Polyethylene tubing SDR 7 and SDR 9 with 160 PSI minimum pressure rating.
Type K Copper tubing or galvanized pipe.

**2. Diameters greater than or equal to 1 1/2-inch:**

a. PVC ASTM D 2241 SDR 13.5, 17, 21 or 26.

b. ABS ASTM D 1527 Schedule 40, 80.
   ASTM D 2282 SDR 13.5, 17, 21, or 26.

c. Waterworks grade ductile iron pipe with mechanical or tyton joints.

d. Type K Copper tubing or galvanized pipe.

[1] See *Figure 3-1, Minimum Separation Distances*, for minimum separation distances requirements for standard and upgraded pipe. Upgraded pipe may be substituted for standard pipe.

## B. Size, Slope & Installation Requirements

1. Requirements for gravity sewers.
   a. Gravity sewers must be at least four (4) inches in diameter.
   b. Gravity sewers must have minimum slopes as listed in *Figure 5-3, Minimum Slopes for Gravity Sewers*.
   c. Requirements for installation of gravity sewers.
      1) Backfill for gravity sewers must be debris-free soil material and backfilled in a manner to prevent the movement of effluent along the outside of the pipe, without damaging the pipe.
      2) All joints must be sealed according to the manufacturer's recommendations.

**Figure 5-3**
**Minimum Slopes for Gravity Sewers***

| Size (diameter, in.) | Minimum Slope | |
|---|---|---|
| | In: ft./100 ft. | In: in./25 ft. |
| 4 | 1.33 | 4 |
| 6 | 0.61 | 1.83 |
| 8 | 0.40 | 1.20 |
| 10 | 0.28 | 0.84 |
| 12 | 0.22 | 0.66 |
| 15 | 0.15 | 0.45 |
| 16 | 0.14 | 0.42 |
| 18 | 0.12 | 0.36 |
| 21 | 0.10 | 0.30 |
| 24 | 0.08 | 0.24 |
| * Based on the Hazen-Williams formula using C=140. | | |

2. Requirements for effluent sewers.
   a. Effluent sewers must be at least four (4) inches in diameter.
   b. Requirements for installation of effluent sewers.
      1) Effluent sewers must have a positive grade of at least two and four-tenths (2.4) inches per one hundred (100) feet or a grade of two (0.2) percent.
      2) Backfill of effluent sewers must be debris-free soil material and backfilled in a manner to prevent the movement of effluent along the outside of the pipe, without damaging the pipe.
      3) All joints must be sealed according to the manufacturer's recommendations.
      4) Effluent Sewers & Distribution Boxes
         a) The distribution box must be at least five (5) feet from the aggregate of any trench or from any chamber.

b) The invert of each effluent sewer that outlets from a distribution box must be at the same elevation so that each gravity distribution lateral receives an equal volume of effluent.

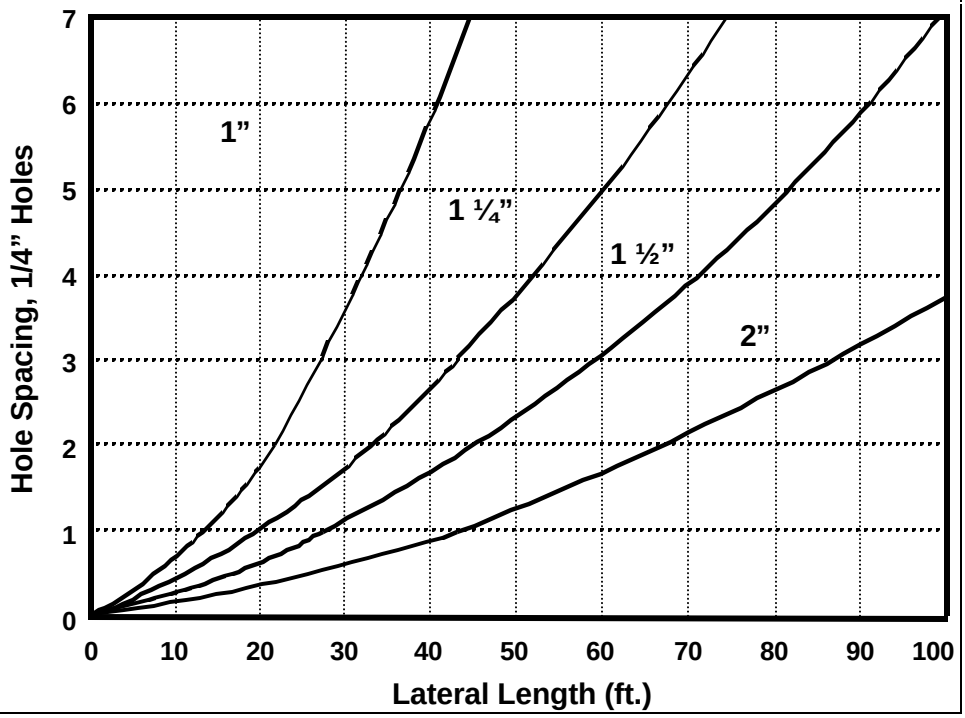
c) Each effluent sewer from an outlet of a distribution box that directly serves a soil absorption field must extend into the aggregate of a trench or into a chamber.

3. Requirements for effluent force mains.
   a. Effluent force mains must be one (1) to six (6) inches in diameter.
   b. Effluent force main diameters are a function of flow and friction loss and are determined from *Appendix C, Figure 5-4, Pipe Diameter, Flow, Velocity & Friction Loss Head*.
   c. Requirements for installation of effluent force mains.
      1) Backfill of effluent force mains must be debris-free soil material and backfilled in a manner to prevent the movement of effluent along the outside of the pipe, without damaging the pipe.
      2) All joints must be sealed according to the manufacturer's recommendations and withstand the pressures exerted on them.
4. Requirements for manifolds.
   a. Manifolds must be one (1) to six (6) inches in diameter.
   b. Manifold diameters are a function of length, flow, number of laterals, and friction loss head (see *Section IX. C., Manifolds*, and *Chapters 6 and 7*), and are determined from *Appendix C, Figure 5-5, Determination of Manifold Diameters*.
   c. Requirements for installation of manifolds.
      1) Backfill of manifolds for trench pressure onsite systems must be debris-free soil material and backfilled in a manner to prevent the movement of effluent along the outside of the pipe, without damaging the pipe.
      2) Backfill of manifolds for sand mound onsite systems must be debris-free aggregate and placed without damaging the pipe.
      3) All joints must be sealed according to the manufacturer's recommendations and withstand the pressures exerted on them.
5. Requirements for gravity distribution laterals in aggregate trenches.
   a. Gravity distribution laterals must be four (4) inches in diameter.
   b. Gravity distribution laterals must have two (2) or three (3) rows of holes separated by one hundred and twenty (120) degrees.
   c. Gravity distribution laterals must have five-eighths (5/8) inch or three-quarter (3/4) inch hole diameter. Holes must be spaced at five (5) inches or less.
   d. Requirements for installation of gravity distribution laterals in aggregate trenches.
      1) Gravity distribution laterals must be installed level along their length.
      2) Each gravity distribution lateral must be placed in aggregate in the trench.
      3) The rows of holes of two (2) hole gravity distribution laterals must be located at one hundred and twenty (120) and two hundred and forty (240) degrees from vertical (rows of holes at 4 o'clock and 8 o'clock).

4) The rows of three (3) hole gravity distribution laterals must be located at one hundred and twenty (120), two hundred and forty (240), and three hundred and sixty (360) degrees from vertical (rows of holes at 4 o'clock, 8 o'clock, and 12 o'clock).
5) The distal end of each gravity distribution lateral must be capped.
6) All joints and end caps must be connected according to the manufacturer's recommendations.

6. Requirements for pressure distribution laterals.
   a. Pressure distribution laterals must be one (1) to two (2) inches in diameter.
   b. Pressure distribution lateral diameters are a function of length, hole size and spacing, and are determined from *Figure 5-6, Pressure Distribution Lateral Diameter*.

***Figure 5-6***
***Pressure Distribution Lateral Diameter***




   c. Requirements for installation of pressure distribution laterals.
      1) Pressure distribution laterals must be installed level along their length.
      2) Requirements for the location of pressure distribution laterals.
         a) Each pressure distribution lateral in an aggregate trench must be placed in the aggregate with the holes facing down.
         b) The bottom of each pressure distribution lateral in a chamber must be securely located at least six (6) inches above the infiltrative surface of the trench with holes facing up.
      3) The distal end of each pressure distribution lateral must be capped.

4) All joints and end caps must be sealed according to the manufacturer's recommendations and withstand the pressures exerted on them.

7. Requirements for subsurface drainpipes.
   a. Subsurface drainpipe must be slotted and at least four (4) inches and no more than eight (8) inches in diameter.
   b. All caps, joints, elbows, and connectors for drainpipe must be:
      1) The same material as the drainpipe; and
      2) Installed according to manufacturer's recommendations.
   c. See *Chapter 4, Section II* for subsurface drainpipe installation requirements.

## III. Grease Traps or Grease Interceptors

Grease traps, grease interceptors, or grease recovery units are used to reduce concentrations of fats, oils, and grease (FOG) in commercial facilities having food services that contain high amounts of food service wastes.

A. A grease trap, grease interceptor, or grease recovery unit is required:
   1. For commercial facilities with design daily flow (DDF) of greater than seven-hundred and fifty (750) gallons per day (gpd) having food services that contain FOG concentrations greater than one-hundred (100) milligrams per liter (mg/l).
   2. On the gravity sewer and before a septic tank for all facilities described in *Section III. A. 1. of this Chapter.*

B. A grease trap, grease interceptor, or grease recovery unit must:
   1. Not receive sewage from non-food service operations or dish machines.
   2. Be provided with easy access for periodic maintenance and cleaning.
   3. Have a retention capacity based upon the manufacturer's recommendations.
   4. Meet the requirements of *The Plumbing and Drainage Institute Standard PDI-G101, 1949*.

C. A grease trap, grease interceptor, or grease recovery unit may be located inside or outside a building.

D. A grease trap, grease interceptor, or grease recovery unit must:
   1. Be inspected monthly by the owner or operator for accumulation of FOG; and
   2. Pumped clean, as needed, to prevent the discharge of FOG greater than one-hundred (100) milligrams per liter (mg/l) to the septic tank.

## IV. Septic Tanks

Septic tanks are primary treatment and provide only partial treatment of sewage by the separation of liquids from solids and scum. Secondary treatment provides additional treatment and is covered in Chapter 8.

A. General Requirements
   1. All onsite systems must have a septic tank.

2. The effluent from a septic tank is partially treated sewage and must discharge to a soil absorption field with no outlet, or a dose tank or secondary treatment device that discharges to a soil absorption field with no outlet.
3. Only septic tanks approved by the department are permitted for use in Indiana.
4. Plans and specifications for septic tanks must be approved by the department.
5. Pumps, pump vaults, and pump pits must not be installed in a septic tank used for onsite systems described in this document.

B. Standards, Septic Tank Capacity

1. Septic tanks for residential onsite systems must have a minimum capacity below the outlet as specified in *Figure 5-7, Septic Tank Capacities for Residential Onsite Systems*.

**Figure 5-7**
**Septic Tank Capacities for Residential Onsite Systems**

| Number of Bedrooms in Residence[1] | ≤ 3 | 4 | 5 | > 5 |
|---|---|---|---|---|
| Design Daily Flow (gallons) | ≤ 450 | 600 | 750 | >750 |
| Liquid Capacity of Tank (gallons) [2] | 900 | 1,200 | 1,500 | * |

[1] Each bathtub and jetted bathtub ≥ 125 gallon capacity is equivalent to 1 bedroom.
[2] Liquid capacity below the invert of the outlet of the tank.
* 1,500 gallons + (300 gallons x number of bedrooms > 5).

2. Septic tanks for commercial facilities must have a capacity below the invert of the outlet, or a combined capacity for tanks in series, to provide for at least two (2) days retention time for sewage.
3. The minimum capacity of a septic tank is nine-hundred (900) gallons.
4. All onsite systems, except as provided for in *Chapter 8, Section I. G. 3. a.*, must have either:
   a. A single two (2) compartment septic tank; or
   b. At least two (2), and no more than three (3), single compartment septic tanks in series.
5. The liquid volume of:
   a. The first compartment of a two-compartment septic tank must be two thirds (2/3) of the total volume of the septic tank; and
   b. The first tank of single compartment septic tanks used in series must be at least one half (1/2) of the total required volume of the septic tanks.

C. Construction Requirements, All Septic Tanks

This section pertains to all precast concrete, cast-in-place concrete, polyethylene, and fiberglass-reinforced polyester septic tanks.

1. Septic tanks must be watertight and constructed of durable material. Metal and wood septic tanks are prohibited.
2. Septic tanks and appurtenances must comply with *International Association of Plumbing and Mechanical Officials Material and Property Standard for Prefabricated Septic Tanks* except when it deviates from the requirements of the *Technical Specification for Onsite Sewage Systems*.

## D. Dimensional Requirements, All Septic Tanks

1. The minimum water depth in any compartment must not be less than two and one-half (2 1/2) feet.
2. The maximum water depth in any compartment must not exceed six and one-half (6 1/2) feet.
3. Baffles, sanitary tees, vented elbows, and the top of the partition wall in two (2) compartment tanks, must extend at least six (6) inches above the liquid level of the tank, or one-tenth (0.1) times the liquid depth in inches, whichever is greater.
4. Transfer ports in the partition or divider wall between compartments must be:
   a. Located at four-tenths (0.4) to five-tenths (0.5) of the distance from the invert of the outlet to the bottom of the septic tank; and
   b. Constructed without tees or elbows.

## E. Access Opening Requirements, All Septic Tanks

There are two types of access openings required in the top of septic tanks. These are access openings for maintenance of the tank (maintenance accesses), and access openings for inspection (inspection accesses).

1. All maintenance accesses must be large enough and positioned in such a way as to allow for proper maintenance, cleaning and servicing of septic tanks and outlet filters.
2. Maintenance accesses must be provided for:
   a. The top of each septic tank; and
   b. The top of each compartment of multi-compartment tanks.
3. Two-compartment septic tanks must be provided with two maintenance accesses, each with a minor dimension of at least fifteen (15) inches. The maintenance accesses must be located:
   a. In the first compartment over either:
      1) The inlet baffle or tee; or
      2) The center of the first compartment.
   b. In the second compartment over the outlet filter.
4. Each tank of single-compartment septic tanks used in series with:
   a. Capacities of fifteen hundred (1500) gallons or less must be provided with one (1) maintenance access with a minimum dimension of fifteen (15) inches over the outlet baffle(s) and the outlet filter; and
   b. Capacities of greater than fifteen hundred (1500) gallons must be provided with two (2) maintenance accesses with minimum dimensions of fifteen (15) inches, one of which must be located over the outlet baffle(s) and the outlet filter.
5. Requirements for inspection accesses.
   a. An inspection access with a minor dimension of fifteen (15) inches is required over the inlet baffle.
   b. An inspection access is not required over the partition or divider wall between compartments.
   c. A riser is not required over inspection accesses.

6. When the top of the septic tank is installed at or above grade, all access openings must be fitted with watertight, securely fastened covers.
7. All access openings for septic tanks for a residence must also comply with the requirements of *IC 16-41-25-3*.

F. Riser Requirements, All Septic Tanks

1. The septic tank manufacturer must provide risers, riser covers, and all appurtenances.
2. The inside dimensions of the riser opening must be greater than the dimensions of the access opening.
3. Risers and riser covers must be made of corrosion resistant materials and withstand design external loads.
4. When the top of the septic tank is installed below grade, risers must:
   a. Be installed over maintenance accesses.
   b. Extend to or above final grade.
   c. Be fitted with a watertight cover securely fastened to the riser; and
   d. For residences, comply with the requirements of *IC 16-41-25-3*.
5. Concrete risers and riser covers may be used only on concrete tanks.
6. Concrete risers must be either:
   a. Cast-in-place during the manufacture of the tank; or
   b. Placed on top of concrete septic tanks using butyl rubber sealant between the septic tank and the riser that meets or exceeds the requirements of *ASTM C-990, Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Sections Using Preformed Flexible Joint Sealants, Section 6.2, Butyl Rubber Sealant according to the manufacturer's design and installation requirements.*
7. Polyethylene and PVC risers may be used with concrete tanks only when they are cast in place during the manufacture of the septic tank.
8. When it is necessary to extend a concrete, polyethylene, or PVC riser using riser sections, butyl rubber sealant that meets or exceeds the requirements of *ASTM C-990, Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Sections Using Preformed Flexible Joint Sealants, Section 6.2, Butyl Rubber Sealant* must be used.

G. Outlet Filter Requirements

1. An outlet filter must be installed:
   a. In all new onsite systems and repair onsite systems requiring a new septic tank; and
   b. After all aerobic treatment units in new onsite systems and repair onsite systems.
2. Outlet filters must:
   a. Conform to *ANSI/NSF Standard 46, Evaluation of Components and Devices Used in Wastewater Treatment Systems*; and.
   b. Be designed to meet or exceed the design daily flow (DDF) of the onsite system.

3. Use and sizing of outlet filters must be in accordance with manufacturer's recommendations.
4. For onsite systems requiring repair or replacement, the department or local health department may require an outlet filter. The outlet filter may be located in a secondary watertight structure located after the last septic tank.
5. Outlet filters must be located:
    a. In the second compartment of two-compartment tanks.
    b. In the last tank when two or more tanks are used in series.
    c. In or after aerobic treatment units.
6. An outlet baffle and gas deflection baffle must be installed in the septic tank(s) located upstream of the last septic tank.
7. The outlet filter housing or septic tank must provide:
    a. A scum space of six (6) inches, or one-tenth (0.1) times the liquid depth in inches, whichever is greater; and
    b. A gas deflection device.
8. Outlet filters must be:
    a. Placed to allow accessibility for routine maintenance without entering the tank; and
    b. Maintained by the owner or agent and must remain in service for the life of the septic tank.
9. Service must be performed as required, but no less than each time the septic tank is pumped.

# V. Dose Tanks

## A. General Requirements

1. A dose tank is required for all flood dose, trench pressure and sand mound onsite systems.
2. The effluent from a dose tank is partially treated sewage and must discharge to a soil absorption field with no outlet, or secondary treatment device that discharges to a soil absorption field with no outlet.
3. Only dose tanks approved by the department are permitted for use in Indiana.
4. Plans and specifications for dose tanks must be approved by the department.
5. The dose tank inlet must be fitted with a sanitary tee, or vented elbow, placed in the vertical direction and extend to within twelve (12) inches of the tank bottom.

## B. Standards, Capacity

1. The required liquid holding capacity of a dose tank must not be considered as any portion of the required liquid volume of the septic tank.
2. The minimum capacity of a dose tank includes the following:
    a. The volume necessary to keep the pump submerged at all times.
    b. The volume of the dose equal to the design daily flow (DDF) of the onsite system divided by the number of doses per day.
    c. The volume, if any, which drains back from the effluent force main and manifold after each dose.

d. The volume necessary to provide for a high water alarm to function. The high water alarm switch must be set at a level below the invert elevation of the inlet and at least four (4) inches above the “on float” position.

C. Construction Requirements, All Dose Tanks

1. Dose tanks must be watertight and constructed of durable material. Metal, wood, and cast-in-pace concrete dose tanks are prohibited.
2. Dose tanks and appurtenances must comply with applicable sections of the *International Association of Plumbing and Mechanical Officials Material and Property Standard for Prefabricated Septic Tanks* except when it deviates from the requirements of the *Technical Specification for Onsite Sewage Systems*.

D. Access Openings, All Dose Tanks

1. All dose tank tops must be provided with a maintenance access.
2. The maintenance access must be large enough to allow access to maintain the tank, and maintain and remove pump(s) and floats, without entering the tank.
3. The maintenance access must be fitted with a cover that:
   a. Allows for proper venting of the tank;
   b. Is securely fastened; and
   c. Prevents the entry of surface water into the tank.
4. Access openings for residences must comply with the requirements of *IC 16-41-25-3*.

E. Riser Requirements, All Dose Tanks

1. When the top of the dose tank is installed below grade, risers must:
   a. Be installed over the maintenance access, and
   b. Extend to or above final grade.
2. Risers must comply with the requirements of *Section IV. F.* of this chapter.

## VI. Structural Integrity, Connectors, Quality Control, Product Marking & Standards for Tank Installation

A. Requirements for Structural Integrity of Tanks

1. Prior to approval by the department, all tanks must be tested for structural integrity by an independent third party.
   a. Precast concrete tanks must be vacuum tested by:
      1) Sealing the tank when empty; and
      2) Applying a vacuum to two (2) inches of mercury.
      3) The tank must hold ninety (90) percent of the vacuum for a period of two (2) minutes.
   b. Polyethylene and fiberglass-reinforced tanks must be strength tested in accordance with *CAN/CSA-B66-00 Prefabricated Septic Tanks and Sewage Holding Tanks.*
2. All septic tanks and dose tanks must be designed to withstand:
   a. At least two (2) feet of soil material cover; and

b. Live loads of at least three-hundred (300) lb/ft$^2$.

3. Structural design calculations must be:
   a. Retained by the manufacturer;
   b. Available for inspection; and
   c. Submitted to the department upon request.

## B. Connectors in Septic Tanks, Dose Tanks, and Distribution Boxes

1. Connector openings must be watertight, and incorporate a rubber gasket that:
   a. Is made of polyisoprene or natural rubber;
   b. Meets or exceeds the requirements of ASTM C-923;
   c. Has a minimum tensile strength of 1600 psi; and
   d. Provides hydrostatic sealing to 5 psi and vacuum sealing to ten (10) inches of mercury.
2. For septic tanks and dose tanks, the seal between the connector and the pipe must be made by using an external compression take-up clamp. The clamp must:
   a. Be constructed of Series 304 or Series 305 non-magnetic stainless steel;
   b. Use no welds in its construction; and
   c. Be adjusted using a screw and a torque setting wrench.
3. For distribution boxes, the seal between the connector and the pipe must be made by mechanical means or by compression.

## C. Testing Requirements, Septic Tanks and Dose Tanks

1. Strength testing must be performed on concrete, polyethylene and fiberglass-reinforced polyester tanks.
   a. For concrete tanks, concrete strength tests must be conducted in accordance with *ASTM C 39, Test Method for Compressive Strength of Cylindrical Concrete Specimens*.
      1) For precast concrete tanks, compression tests must be performed and recorded on test cylinders for every one-hundred and fifty (150) yards of concrete poured.
      2) For cast-in-place concrete tanks, compression tests must be performed on test cylinders for every truckload of concrete used.
   b. For polyethylene and fiberglass-reinforced polyester tanks, strength tests must be performed in accordance with *CAN/CSA-B66-00*, *Section 8, Strength Test*. The manufacturer must select, at random, one (1) in every forty (40) tanks for testing.
2. Tank leakage tests must be performed on concrete, polyethylene and fiberglass-reinforced polyester tanks.
   a. For precast concrete tanks, the manufacturer must select at random one (1) of every twenty (20) tanks to test for tank leakage. Tanks must be tested in accordance with *ASTM C 1227-02a, Section 9, Performance Test Methods.*
   b. Each cast-in-place and site constructed concrete tank must be leak tested by:
      1) Sealing the tank, filling with water, and letting stand for twenty-four (24) hours; and

2) Refilling the tank.
3) The tank must hold the water level constant for a period of one (1) hour.

c. For polyethylene and fiberglass-reinforced polyester tanks, the manufacturer must select at random one (1) of every twenty (20) tanks to test for tank leakage. Tanks must be tested in accordance with *CAN/CSA-B66-00*, *Section 8.3, Watertightness Test.*

3. Documentation of strength tests and tank leakage tests must be:
   a. Retained by the manufacturer and be available for inspection by the department.
   b. Retained by the designer of cast-in-place septic tanks and be available for inspection by the department.

## D. Product Marking

1. All product marking must be by indentation, raising, or waterproof stenciling or embossing.
2. All septic tanks and dose tanks must be marked.
   a. Markings must be located on the outside of the tank on the side of the tank beside an access opening.
   b. The marking must include:
      1) The name or trademark of the manufacturer;
      2) Month and year of manufacture;
      3) Liquid capacity of the tank in gallons; and
      4) Maximum recommended depth of soil material cover in feet.
3. All covers for access openings and all covers for risers must be marked with a warning that entrance into the tank could be fatal.
4. All distribution boxes must be marked. The marking must include:
   a. The name or trademark of the manufacturer;
   b. Month and year of manufacture; and
   c. Model number of the distribution box.

## E. Standards for Installation, Septic Tanks and Dose Tanks

1. *Occupational Safety and Health Administration* (*OSHA*) requirements for confined space entry must be followed before entering a tank.
2. Tanks must be installed level on either undisturbed or compacted soil material or on at least four (4) inches of sand or aggregate no larger than one and one-half (1 1/2) inches in diameter.
3. The owner or agent must obtain written confirmation from the manufacturer that the tank will withstand the actual load applied for any tank installation exceeding the design load. A copy of the written confirmation must be provided to the local health department or department.
4. Tank and riser joints must be watertight.
   a. Adhesion surfaces must be clean and dry.
   b. Joint sealant for concrete tanks must be butyl rubber and meet or exceed the requirements of *ASTM C-990, Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Sections Using Preformed*

*Flexible Joint Sealants, Section 6.2, Butyl Rubber Sealant*, and be installed according to manufacturer's installation recommendations.

5. Drain holes in precast concrete tanks must be:
   a. Cast-in using a female-threaded PVC opening; and
   b. Plugged using a male-threaded PVC plug by the manufacturer before the tank is delivered for use.
6. Manufacturer's recommendations for the anchoring of fiberglass and polyethylene tanks must be followed.
7. Where the water table is above the base of the tank during installation, the tank must be filled with water to prevent floatation.
8. Pipe installed in connectors must be restrained from movement during backfill operations.
9. Requirements for soil material backfill.
   a. Soil material must be debris-free.
   b. Stones must have no dimension greater than three (3) inches.
   c. Soil material must be placed in layers twelve (12) to twenty-four (24) inches thick.
   d. Each layer of soil material must be backfilled in a manner to prevent settling.
10. The final grade must divert surface water away from the tank access opening covers.

## VII. Abandonment or Removal of Septic Tanks and Dose Tanks

### A. Responsibility

1. The owner or agent is responsible for abandonment or removal of all tanks.
2. Tanks must be abandoned or removed when the useful life of the tank has been exceeded or when an onsite system is abandoned.

### B. Abandoned-in-Place

1. The tank must be pumped and cleaned by a wastewater management business licensed by the Indiana Department of Environmental Management.
2. Upon request, a copy of the receipt for pumping the tank must be provided to the local health department.
3. The tank cover must be:
   a. Removed or collapsed into the tank and the tank filled with debris-free sand, other granular material, or soil material that is backfilled in a manner to prevent settling; or
   b. Left in place and the tank filled with flowable fill as defined in Indiana Dept of Transportation Standard Specifications.

### C. Removal

1. The tank must be pumped and cleaned by a wastewater management business licensed by the Indiana Department of Environmental Management.
2. Upon request, a copy of the receipt for pumping the tank must be provided to the local health department.

3. The tank must be removed and the remaining excavation filled with debris-free sand, other granular material, or soil material that is backfilled in a manner to prevent settling.

## VIII. Pumps

Pumps are required for flood dose, trench pressure, and sand mound onsite systems. They provide the energy necessary to overcome forces that resist the flow of effluent. These forces are referred to as "head" and are measured in "feet of head". The following terms are used in this document:

- "Static" head ($H_S$)—In onsite systems, static head is the energy required to overcome the difference in elevation between the dose tank pump (off position) and the highest point between the dose tank and the soil absorption field. For flood dose onsite systems, the highest point is the invert of the inlet of the distribution box or the highest elevation of the effluent force main, whichever is greater. For trench pressure onsite systems and sand mound onsite systems, the highest point is the highest elevation in the pressure distribution network or the highest elevation of the effluent force main, whichever is greater.
- "Friction loss" head ($H_F$)—In onsite systems, friction loss head is the energy required to overcome the resistance (friction) to flow in the effluent force main.
- "Design" head ($H_D$)—In onsite systems, design head is the energy required to maintain an in-line residual pressure in the pressure distribution laterals.

This section provides technical information on the sizing and installation of pumps.

### A. Calculation of Total Dynamic Head

1. Total dynamic head (TDH) is the sum of static head, friction loss head, and design head ($TDH = H_S + H_F + H_D$).
2. Friction loss head ($H_F$) in an effluent force main is determined from *Appendix C, Figure 5-4, Pipe Diameter, Flow, Velocity and Friction Loss Head*.
3. The following design head is used for onsite systems with pumps.
   a. In flood dose onsite systems with a distribution box, the design head ($H_D$) is zero (0) feet.
   b. In trench pressure onsite systems with constant diameter manifolds, and sand mound onsite systems, the design head ($H_D$) is three (3) feet.
   c. See *Chapter 6, Section IV. D., Variable Manifold Sizing and Variable Hole Spacing Designs*, for the calculation of design head ($H_D$) for trench pressure onsite systems.

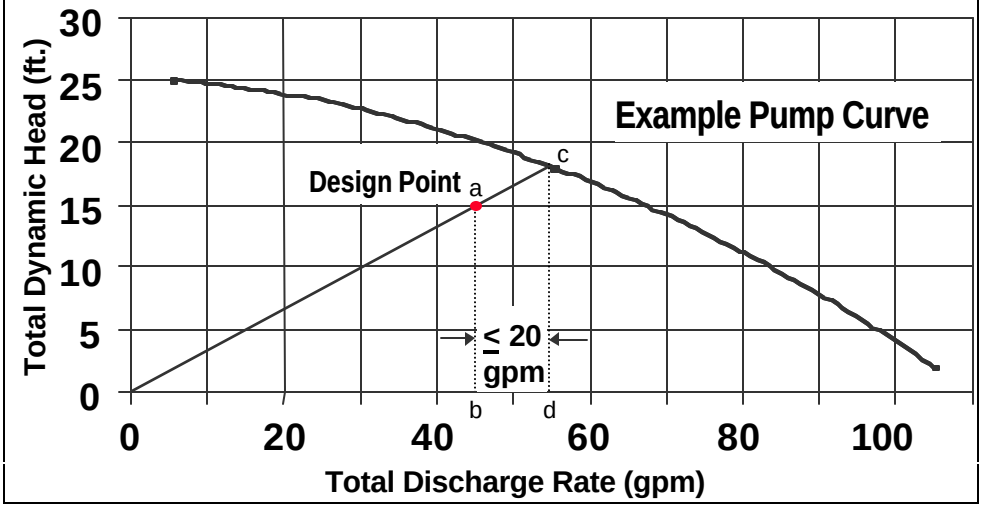
### B. Calculation of Total Discharge Rate

The calculation of the total discharge rate (TDR) is included for each onsite system having a pump in *Chapter 6, Trench Onsite Systems*, and *Chapter 7, Sand Mound Onsite Systems*. These include flood dose onsite systems with a distribution box, trench pressure onsite systems with constant diameter manifolds, trench pressure onsite systems with variable manifold sizing, trench pressure onsite systems with variable hole spacing, and sand mound onsite systems.

## C. Pump Selection

1. Pumps for onsite systems must be:
   a. Suitable for use in a corrosive environment;
   b. Rated by the manufacturer for effluent service; and
   c. Submersible.
2. Pumps for onsite systems must meet or exceed:
   a. The total dynamic head (TDH); and
   b. The total discharge rate (TDR) of the onsite system.
3. Pump selection for an onsite system must be based on the manufacturers' pump curve for the total dynamic head (TDH) and total discharge rate (TDR).
4. The following procedure must be used in determining the correct pump size (see *Figure 5-8, Pump Selection* and points *a., b., c., and d*. corresponding to the following subsections):
   a. Plot the TDH and TDR design point of the onsite system on the manufacturer's pump curve graph. The design point of the onsite system (the intersection of the TDH and the TDR) must be below the pump curve.
   b. Draw a vertical line from the design point to the 'Total Discharge Rate (gpm)'-axis.
   c. Draw a line from the origin of the manufacturers' pump curve graph through the design point to the pump curve.
   d. At the intersection of this line with the pump curve, draw a vertical line to the 'Total Discharge Rate (gpm)'-axis.
   e. The pump is acceptable when the difference between these two vertical lines along the gpm-axis is twenty (20) gallons per minute or less.

**Figure 5-8**
**Pump Selection**




## D. Installation

1. Pumps must be installed according to manufacturer's installation recommendations.

2. Pumps and associated components must be corrosion resistant.
3. A non-corrosive lifting mechanism must be installed.
4. Requirements for breakaway flanges, unions, and guide rails.
    a. A threaded PVC or cam-lock union, breakaway flange, or guide rails must be utilized to make a pump accessible for maintenance without having to enter the dose tank.
    b. For onsite systems with a design daily flow (DDF) of seven hundred and fifty (750) gallons per day or less, a threaded PVC union, cam-lock union, or breakaway flange may be used. In this application, the union or flange must be located above the level where the high water alarm is activated.
    c. For commercial facility onsite systems with a DDF of greater than seven-hundred and fifty (750) gallons per day (gpd), and when breakaway flanges and unions are not accessible without having to enter the dose tank, guide rails must be used.
    d. Breakaway flanges, cam-lock unions and guide rails must be corrosion resistant. Galvanized metals are not acceptable.
5. Requirements for encapsulated float switches.
    a. Encapsulated float switches must be used for dose tank pump start and stop controls, and the high water alarm.
    b. Encapsulated float switches, and float control hangers (if installed), must be made from non-corrosive materials. Galvanized metals are not acceptable.
    c. The stop control encapsulated float switch must be set so that the pump is submersed at all times.
    d. The tethers of encapsulated float switches must be attached to a non-corrosive permanent structure other than the effluent force main.
    e. Encapsulated float switches and tethers must be adjustable to provide the required dose volume for the onsite system as determined from *Figure 6-2, Dose Volume for Flood Dose and Trench Pressure Onsite Systems* and *Chapter 7, Section II., C., 2. Dose Volume for Sand Mound Onsite Systems*.
6. If a check valve is installed, a one-quarter (1/4) inch diameter weep hole must be drilled in the pipe downstream of the check valve to drain the effluent force main to the dose tank.
7. The high water alarm float or lag float must be set at a level below the invert elevation of the tank inlet and at least four (4) inches above the on-float.
8. The high water alarm must:
    a. Be audible and visible;
    b. Be on a separate electrical circuit from the pump;
    c. Lock-on (with manual reset) with any pump failure; and
    d. Be able to be tested for proper operation.
9. The alarm must not be located in crawl spaces, window wells, or other inaccessible places.
10. Controls, other than encapsulated floats, must not be located within the dose tank.

11. The junction box located in the dose tank riser must be rated as a *National Electrical Manufacturer's Association 4X (NEMA 4X)*. All connectors to the junction box must:
    a. Form a watertight seal to the junction box; and
    b. Form a watertight seal between connector openings and incoming wires.
    c. Any connector not used for wiring must be fitted with a watertight plug.
12. For commercial facility onsite systems with design daily flows (DDF) of greater than seven hundred and fifty (750) gallons per day, the audio/visual alarm, alternating switch, and other control devices must be located in a control panel. The control panel must be vandal proof.
13. Electrical wiring and devices must be installed in accordance with the *Indiana Electrical Code* and meet all local code requirements.

# IX. Distribution of Effluent

## A. Manufactured Distribution Boxes

1. General requirements for manufactured distribution boxes.
    a. Only manufactured distribution boxes approved by the department are permitted for use in Indiana.
    b. Plans and specifications for distribution boxes must be approved by the department.
    c. The manufacturer must assign a product number that is specific to the distribution box design and total number (inlet and outlet) of holes.
    d. For the distribution of effluent in gravity onsite systems, a distribution box or series of distribution boxes must be installed between the septic tank and the soil absorption field(s).
    e. For the distribution of effluent in flood dose onsite systems, a distribution box or series of distribution boxes must be installed between the dose tank and the soil absorption field(s).
    f. Each distribution box must be designed to divide the effluent flow equally among the outlets.
    g. Each effluent sewer from a distribution box must connect directly to:
        1) The gravity distribution lateral of an aggregate trench;
        2) The first chamber of a chamber trench; or
        3) The inlet of another distribution box.
2. Requirements for materials and construction of distribution boxes.
    a. Distribution boxes, including all joints, inlets, outlets and risers, must be watertight and constructed of durable material. Metal and wood distribution boxes are prohibited.
    b. Risers, where provided, must be watertight and made of corrosion resistant materials and withstand anticipated external loads.
    c. Distribution boxes and risers must be fitted with a watertight, removable lid.
    d. Connectors must in compliance with the requirements of *Section VI. B. 1.,* of this chapter.
    e. For concrete distribution boxes:

1) Concrete must have a minimum strength of four-thousand (4,000) pounds per square inch (psi) at twenty-eight (28) days.
2) The average thickness of the wall, floor, and lid must be one and one-half (1 1/2) inches and no less than one (1) inch.

f. Product marking must be in compliance with *Section VI. D. 4.*, of this chapter.

3. Requirements for dimensions of manufactured distribution boxes.
   a. The interior bottom of the distribution box must be at least one hundred and forty-four (144) square inches in area.
   b. The interior bottom of the distribution box must be at least four (4) inches below the bottom of the outlets.
   c. Sidewalls must extend a minimum of eight (8) inches above the bottom of the outlets.
   d. The outlets must be located at least one (1) inch lower than the inlet.
   e. All outlets must be at the same distance from the bottom of the distribution box and be of the same diameter.
4. Requirements for effluent velocity reduction.
   a. A device must be used to reduce velocity from the inlet of the distribution box to aid in the equal distribution of effluent to each outlet.
   b. If a baffle is used, the baffle and its mounts or retainers must provide a passageway for effluent between the box bottom and the bottom edge of the baffle of no more than two (2) inches. The baffle must extend at least one (1) inch above the top of the inlet.
   c. If an elbow is used, it must be a ninety (90) degree elbow and turn down into the distribution box. One of the following must be provided:
      1) An air gap (vacuum break) must exist between the outlet of the elbow and the invert elevation of the outlets.
      2) A vacuum break (3/8” diameter hole or equivalent) must be installed in the top half of the elbow.
   d. If, after entering the distribution box, the effluent sewer or effluent force main is perforated to dissipate energy:
      1) The perforations must face down.
      2) The total area of the perforations must exceed the internal cross-sectional area of the effluent sewer or effluent force main.
      3) The perforated pipe must be capped and a vacuum break (hole) must be drilled into the top half of the cap.
5. Requirements for installation of manufactured distribution boxes.
   a. Distribution boxes must be installed level on either undisturbed soil or at least four (4) inches of sand or aggregate no larger than one-half (1/2) inch in diameter.
   b. The distribution box must be at least five (5) feet from the aggregate of any trench or from any chamber.
   c. The invert of each effluent sewer that outlets a distribution box must be at the same elevation so that each gravity distribution lateral receives an equal volume of effluent.
   d. Distribution box riser and lid joints must be watertight.

1) Adhesion surfaces must be clean and dry.
2) Joint sealant must be:
a) At least one (1) inch by one (1) inch closed cell neoprene gasket material and meet or exceed the requirements of *ASTM D 1056, Type 2A, Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber*; and
b) Applied according to manufacturer's installation recommendations.

e. Pipe must be restrained from movement during backfill operations.
f. Backfill for distribution boxes must:
1) Be debris-free soil material; and
2) Installed in a manner to stabilize the box and prevent the movement of effluent along the outside of the pipe and between trenches, and without damage to pipe.
g. The final grade around distribution boxes must divert surface water away from the distribution box.

## B. Diverter Devices

A diverter device is used in alternating field onsite systems.

1. A diverter device must be installed downstream of the septic tank and prior to the distribution boxes.
2. A diverter device must not restrict the flow of effluent and must divert one-hundred (100) percent of the effluent to one (1) soil absorption field at a time.
3. A riser or opening must extend to final grade for adjustment of the diverter device.
4. Diverter devices, including all joints, inlets and risers, must be watertight and constructed of durable material. Metal and wood diverter devices are prohibited.

## C. Manifolds

The application of manifolds is unique to each type of onsite system.

1. Manifolds must be installed as part of pressure distribution networks for trench pressure and sand mound onsite systems.
2. Manifolds must be designed as described in *Chapters 6 and 7* of this document.

## D. Pressure Distribution Networks

1. General requirements for pressure distribution networks.
a. Pressure distribution laterals must be oriented parallel to the contours of the soil absorption field site.
b. Each pressure distribution lateral must be installed level along its length.
c. Each pressure distribution lateral must be individually connected to the manifold.
d. The distal end of each pressure distribution lateral must be capped.
e. All joints and end caps must be sealed according to the manufacturer's recommendations and withstand the pressures exerted on them.
f. Length of each pressure distribution lateral:

1) For onsite systems with a design daily flow (DDF) of seven-hundred and fifty (750) gallons per day or less, the length of each pressure distribution lateral from manifold to end cap must be fifty-five (55) feet or less.
2) For trench pressure onsite systems with a design daily flow (DDF) of greater than seven-hundred and fifty (750) gallons per day, the length of each pressure distribution lateral from manifold to end cap must be one-hundred (100) feet or less without exceeding a two (2) inch diameter. See *Figure 5-6, Pressure Distribution Lateral Diameter*.
3) For commercial facility sand mound onsite systems, the length of each pressure distribution lateral from manifold to end cap must be fifty-five (55) feet or less.

g. Aggregate in trenches and the bed of a sand mound must extend eighteen (18) inches beyond the distal end of each pressure distribution lateral.
h. A pressure distribution lateral in a chamber trench must:
1) Extend to the distal end of the distal chamber; and
2) Meet the requirements of *Section II. B. 6. c. 3*) of this chapter.

2. In pressure distribution networks, the dose volume must be at least seven (7) times the internal volume of the pressure distribution laterals.

### E. Holes in Pressure Distribution Networks

1. All holes drilled in pressure distribution laterals must be free of burrs.
2. All holes drilled in pressure distribution laterals must be one-quarter (1/4) inch diameter.
3. The location of the first hole in pressure distribution laterals must be equal to one-half (1/2) the distance of the hole spacing from the manifold. The first hole is the hole nearest the manifold.
4. The location of the second to last hole in pressure distribution laterals must be equal to or greater than one-half (1/2) the distance of the hole spacing from the distal end cap. The second to last hole is the hole in the lateral nearest to the hole in the end cap. (See *Chapter 6. IV, Trench Pressure Onsite Systems*, and *Chapter 7, Sand Mound Onsite Systems*).
5. Holes must:
a. Face down in trench pressure aggregate trenches and sand mound aggregate beds; and
b. Face up in chamber trenches.
6. Pressure distribution laterals installed in chambers must comply with *Section IX. D. 1. h.* of this chapter.
7. A one-quarter (1/4) inch hole must be drilled horizontally in the upper half of distal end caps. The flow of effluent from the end cap hole must be counted in the total number of holes used to calculate the total discharge rate (TDR).

## X. Barrier Material

### A. Specifications

1. Barrier material must be synthetic fabric, either spun bonded or woven, with openings equivalent to a seventy (70) to one-hundred (100) sieve size.

2. The barrier material must have the following physical characteristics:
    a. Burst strength of twenty-five (25) pounds per square inch or more.
    b. Air permeability of five-hundred (500) cubic feet per minute per square foot or more.
    c. A water flow rate of five-hundred (500) gallons per minute per square foot at three (3) inches of head or more.
    d. A hydrophilic surface reaction to water.
3. The barrier material must have the following chemical characteristics.
    a. Non-biodegradable.
    b. Resistant to acids and alkalies within a pH range of four (4) to ten (10).
    c. Resistant to common solvents.

B. Installation

1. For aggregate trenches and sand mound aggregate beds, barrier material must be placed on the aggregate to prevent soil particle movement into the aggregate.
2. The barrier material must cover the aggregate of aggregate trenches and sand mound aggregate beds from side-to-side and from end-to-end.

# XI. Soil Absorption Fields

A. Size of Soil Infiltrative Surface

1. The soil infiltrative surface [in square feet ($ft^2$)] must be based on the following:

$$\text{Soil infiltrative surface } (ft^2) = \frac{\text{Design daily flow}}{\text{soil loading rate}} = \frac{\text{DDF (gpd)}}{\text{SLR (gpd/ ft}^2\text{)}}$$

2. In this computation, the soil loading rate (SLR) used must be of the most restrictive horizon from all soil profile descriptions evaluated for the soil absorption field site.
    a. For trench onsite systems, the soil loading rate used must be of the most restrictive horizon within twenty-four (24) inches below the proposed infiltrative surface.
    b. For sand mound onsite systems, the soil loading rate used must be of the most restrictive horizon within twenty (20) inches of existing grade.
3. Soil loading rates must be determined using *Appendix C, Figure 3-4, Soil Loading Rates for Onsite Systems*.
4. For trench onsite systems, the soil infiltrative surface area may be adjusted only if all horizons below the infiltrative surface have a soil loading rate of twenty-five hundredths (0.25) or thirty hundredths (0.30) gpd/$ft^2$.
    a. The lessor of the values calculated in *Section XI. A. 4. b.* and *Section XI. A. 4. c.* must be used.
    b. For soils with no evidence of a seasonal high water table, the following formula may be applied:

$$\text{Adjusted soil infiltrative surface } (ft^2) = \frac{\text{DDF (gpd)}}{\text{SLR (gpd/ ft}^2\text{)}} - \left[\frac{\text{DDF (gpd)}}{\text{SLR (gpd/ ft}^2\text{)}} \times 0.009(\text{DL-DT-24})\right]$$

Where: DL = depth (in inches) from original grade to a layer with an SLR of less than twenty-five hundredths (0.25) gpd/ft$^2$, where the soil has no seasonal high water table; and

DT = depth (in inches) from original grade to the proposed soil absorption trench bottom; and

The value for (DL-DT-24) may not exceed thirty-six (36) inches.

c. For soils with a seasonal high water table.

1) If the seasonal high water table is more than twenty-four (24) inches below the bottoms of the proposed soil absorption trenches, the formula in *Section XI. A. 4. b.* of this chapter may be applied. The value for DL must be the depth of seasonal high water table as determined by the soil profile report. The value for (DL – DT – 24) must not exceed thirty-six (36) inches.

2) If the seasonal high water table is within twenty-four (24) inches of the bottoms of the proposed soil absorption trenches, the owner must meet the site drainage requirements of *Chapter 4, Section II.* before applying the formula in *Section XI. A. 4. b*. of this chapter.

3) If the onsite system subsurface drain meets the requirements of *Chapter 4, Section II. C. 1.*, the formula in *Section XI. A. 4. b*. of this chapter may be applied.

4) If the onsite system subsurface drain meets the requirements of *Chapter 4, Section II. C. 2. or 3.*, the formula in *Section XI. A. 4. b.* of this chapter may be applied. The value for DL must be the depth of the onsite system subsurface drain below original grade minus twelve (12) inches. The value for (DL – DT – 24) must not exceed thirty-six (36) inches.

## B. Specifications, Aggregate

1. Aggregate used in onsite systems must be gravel, stone or other materials approved by the department.
   a. Aggregate must be no smaller than one-half (1/2) inch and no larger than two and one-half (2 1/2) inches in diameter.
   b. Crushed limestone aggregate must be rated as forty (40) percent or less on the LA abrasion scale.
   c. Aggregate must be washed by the supplier to remove fines, dust, sand, and clay.
2. The minimum depth of aggregate below the distribution laterals must be six (6) inches throughout the entire length and width of the trench or the aggregate bed in a sand mound.
3. The minimum depth of aggregate above the distribution laterals must be:
   a. Two (2) inches throughout the entire length and width for trenches having a depth of twelve (12) inches or greater.
   b. Two (2) inches above the distribution lateral for:
      1) The entire length for trenches having a depth of ten (10) to twelve (12) inches.
      2) The entire length of aggregate beds in sand mound onsite systems.

## C. Specifications, Chambers

1. Chamber units must be constructed from injection molded high-density polyethylene.
2. Product marking must be by indentation, raising, or waterproof stenciling or embossing and be located on the top of each chamber. Requirements for product marking include:
    a. The name or trademark of the manufacturer.
    b. Month and year of manufacture.
    c. Model number of the chamber, if applicable.
    d. External design live and dead loads for which the chamber is designed to withstand. Dead loads must be expressed in number of feet of soil material.
3. Requirements for the design of each chamber.
    a. Each chamber unit must mechanically interlock to form a complete trench.
    b. The height of the chamber must be at least ten (10) inches.
    c. The distal end of the trench must be fitted with solid end plates that mechanically interlock to the end of the chamber.
    d. The inlet plate must:
        1) Be fitted with a splash plate located below the inlet on the trench bottom; and
        2) Protect the trench bottom from erosion.
4. Requirements for the installation of chambers.
    a. Chambers must be installed in compliance with *410 IAC 6-8.2* and this document, and any additional installation instructions of the manufacturer.
    b. The distance from the infiltrative surface to the inside top of the chamber must be at least ten (10) inches.
    c. The bottom of the effluent sewer entering the inlet end plate must be at least six (6) inches above the splash plate.
    d. Pressure distribution laterals installed in chambers must comply with *Section IX. D. 1. h.* of this chapter.
    e. Backfill must be debris-free soil material.

## D. Cover & Final Grade

1. Cover must be debris-free soil material.
2. The final grade of the onsite system must promote surface drainage away from each component of the onsite system.
3. The soil absorption field must be seeded or sodded with grasses or legumes adapted to the area. If seeded, the seed must be protected by a cover of straw, burlap, or some other material that will protect it against erosion.
4. The soil absorption field must not be used for intensive-use recreation space, cultivation for harvest, or livestock.

# Chapter 6 Trench Onsite Systems

This chapter provides technical information on the design, installation, and construction of subsurface soil absorption trench onsite systems.

## I. General Requirements for Trench Onsite Systems

After all of the applicable site and soil conditions of *Chapter 3* have been met, all of the following provisions must be met to permit the installation and construction of a trench onsite system.

### A. Protection of Soil Absorption Fields

The soil absorption field site must be protected. The site includes the area selected for placement of the soil absorption field, dispersal area, and site drainage; the set aside area, when a set aside area is required; and the area(s) designated for future expansion, when needed.

1. Before the start of any construction at the property, the location of the trench soil absorption field, dispersal area, site drainage, set aside area (if required), and areas designated for future expansion (if required) must be staked out and protected from disturbance.
2. Site preparation, finish grading and soil stabilization must not be constructed during periods when the soil is sufficiently wet, to exceed its plastic limit.
    a. Sufficient samples must be evaluated throughout the soil absorption field site to assure that the plastic limit of the soil is not exceeded.
    b. The plastic limit of a soil is exceeded when the soil can be rolled between the palms of the hands to produce threads one-eighth (1/8) inch in diameter that do not easily break apart or crumble.
    c. Site preparation, finish grading and soil stabilization must not be constructed when the soil is frozen.
3. Site preparation, finish grading and soil stabilization must be performed in accordance with the approved plans.
4. A permit for an onsite system may be revoked in accordance with the requirements of *410 IAC 6-8.2-50 (d) (1)*, for the following:
    a. Alteration of the site, after the written site evaluation report, by the addition of fill, or the cutting, scraping, or removal of soil; or
    b. Compaction of the site, by vehicles or construction equipment before or during construction, resulting in densic materials.

### B. Requirements for Installation and Construction of Trench Onsite Systems

1. Excessive vegetation at the soil absorption field site must be cut and removed without causing densic materials.
2. If trees are present within the proposed soil absorption trench excavation:
    a. Soil absorption trenches may be routed around trees provided the trenches follow the contour of the site (preferable option); or
    b. Tree stumps and root balls may be removed by a backhoe provided the resulting excavation will not exceed the permit requirements for width and depth of the soil absorption trench.
3. Requirements for barrier material and cover of the soil absorption field.

a. The aggregate in aggregate soil absorption trenches must be covered with a barrier material (see *Chapter 5, Section XI. B*.).
b. The barrier material of each aggregate soil absorption trench, and the chambers of each chamber soil absorption trench, must be protected with a minimum of twelve (12) inches of soil material cover.
c. The final grade of the site must promote surface drainage away from the soil absorption field.
d. The soil absorption field site must be seeded or sodded with grasses adapted to the area. If seeded, the soil absorption field site must be covered with straw, burlap, or some other biodegradable material that will protect against erosion.

## C. Requirements for Trench Onsite Systems with Dose Tanks

1. The effluent force main must drain unless it is installed below the frost line (see *Figure 6-1, Frost Penetrations in Indiana*).
2. Pump controls must be set to deliver the dose volume determined from *Figure 6-2, Dose Volume for Flood Dose and Trench Pressure Onsite Systems*.

## D. Design and Construction Requirements for Soil Absorption Trenches

1. Each soil absorption trench must receive effluent in proportion of its infiltrative surface area to the total infiltrative surface area of all trenches:

$$\text{effluent per trench} = \text{DDF} \times \frac{\text{area of individual trench infiltrative surface}}{\text{area of all trench infiltrative surfaces}}$$

where DDF = design daily flow, in gpd.

2. Requirements for soil absorption trenches.
   a. Each trench must be constructed parallel to the contour of the site.
   b. Smearing of the trench bottom or sidewalls during construction must be avoided. Smearing may be grounds for rejection of the onsite system and revocation of the permit.
   c. The infiltrative surface of each trench must be level throughout its length.
   d. Each distribution lateral in aggregate trenches, and chamber soil absorption trenches using pressure distribution, must be level throughout its length.
   e. Soil absorption trenches must meet the following dimensional requirements.
      1) Trenches must be eighteen (18) to thirty-six (36) inches in width as measured at the infiltrative surface.
      2) Trenches must be separated by at least seven and one-half (7 1/2) feet on-center.
      3) Trench bottoms must be no less than ten (10) inches into soil (see *Appendix A, Glossary*, for definition of soil).
      4) Trench bottoms must be no more than thirty-six (36) inches below final grade.

**Figure 6-1**
**Frost Penetrations in Indiana (in inches)**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Adams | 60 | Allen | 60 | Bartholomew | 48 | Benton | 60 |
| Blackford | 60 | Boone | 54 | Brown | 48 | Carroll | 60 |
| Cass | 60 | Clark | 36 | Clay | 54 | Clinton | 54 |
| Crawford | 36 | Daviess | 48 | Dearborn | 48 | Decatur | 48 |
| DeKalb | 60 | Delaware | 60 | Dubois | 42 | Elkhart | 60 |
| Fayette | 54 | Floyd | 36 | Fountain | 60 | Franklin | 48 |
| Fulton | 60 | Gibson | 42 | Grant | 54 | Greene | 54 |
| Hamilton | 54 | Hancock | 54 | Harrison | 36 | Hendricks | 54 |
| Henry | 54 | Howard | 60 | Huntington | 60 | Jackson | 48 |
| Jasper | 60 | Jay | 60 | Jefferson | 42 | Jennings | 48 |
| Johnson | 54 | Knox | 48 | Kosciusko | 60 | LaGrange | 60 |
| Lake | 60 | LaPorte | 60 | Lawrence | 48 | Madison | 60 |
| Marion | 54 | Marshall | 60 | Martin | 48 | Miami | 60 |
| Monroe | 48 | Montgomery | 60 | Morgan | 48 | Newton | 60 |
| Noble | 60 | Ohio | 42 | Orange | 42 | Owen | 54 |
| Parke | 60 | Perry | 36 | Pike | 42 | Porter | 60 |
| Posey | 42 | Pulaski | 60 | Putnam | 54 | Randolph | 54 |
| Ripley | 48 | Rush | 54 | St. Joseph | 60 | Scott | 36 |
| Shelby | 54 | Spencer | 36 | Starke | 60 | Steuben | 60 |
| Sullivan | 54 | Switzerland | 42 | Tippecanoe | 60 | Tipton | 60 |
| Union | 48 | Vanderburgh | 36 | Vermillion | 60 | Vigo | 60 |
| Wabash | 60 | Warren | 60 | Warrick | 36 | Washington | 36 |
| Wayne | 54 | Wells | 60 | White | 60 | Whitley | 60 |

## II. Gravity Onsite Systems

In addition to the requirements of *Section I* of this chapter, all of the following provisions must be met to permit the installation and construction of gravity onsite systems.

### A. Soil Absorption Trenches

1. The total trench length of a gravity onsite system must not exceed five hundred (500) feet, except when permanent electricity is not and will not be available to a commercial facility, the total trench length of a gravity commercial onsite system must not exceed one thousand (1,000) feet.
2. The maximum length of each trench is one hundred (100) feet.
3. The area of the infiltrative surface of each trench served by the same distribution box must be equal.

### B. Distribution Boxes

1. A distribution box must be installed between the effluent sewer and soil absorption field.
2. See *Chapter 5, Section IX. A. 5*., for distribution box installation standards.

**Figure 6-2**
**Dose Volume for**
**Flood Dose[1] & Trench Pressure Onsite Systems**

| Soil Loading Rate at the Infiltrative Surface | Drainage of Effluent Force Main: | |
|---|---|---|
| | To Absorption Field | Back To Dose Tank[2] |
| 0.25 – 0.75 gpd/ft$^2$ | DDF | DDF + $Vol_{FM}$ |
| 1.20 gpd/ft$^2$ | ¼ DDF | ¼ DDF + $Vol_{FM}$ [2] |

*Definitions:*

DDF: Design Daily Flow, in gpd

$Vol_{FM}$: Volume of Effluent Force Main

[1] Flood dose onsite systems are not allowed in soils with a horizon within 24" of the infiltrative surface with a SLR > 0.75 gpd/ft$^2$.

[2] If the high point in the effluent force main occurs between the dose tank and the header or manifold, the volume in the effluent force main from the high point to the dose tank must be added to the dose volume.

Note: In trench pressure onsite systems with constant diameter manifold, if the manifold drains back to the dose tank, the volume of the manifold ($Vol_M$) must be added to the dose volume.

## III. Flood Dose Onsite Systems

In addition to the requirements of *Section I* of this chapter, all of the following provisions must be met to permit the installation and construction of flood dose onsite systems.

### A. Distribution of Effluent & Soil Absorption Trenches

1. A distribution box must be installed between the effluent force main and the soil absorption field.
2. The total trench length of flood dose onsite systems must not exceed one thousand (1,000) feet per pump.
3. The maximum length of each trench is one hundred (100) feet.

### B. Distribution Boxes

Distribution boxes must be installed according to the requirements of *Chapter 5, Section IX. A. 5*.

### C. Pump Selection for Flood Dose Onsite Systems

1. Calculation of total discharge rate.
   a. For flood dose onsite systems with a design daily flow (DDF) of less than three-hundred (300) gallons per day (gpd), the total discharge rate (TDR) must be thirty (30) gallons per minute (gpm).
   b. For flood dose onsite systems with a design daily flow (DDF) of three-hundred (300) gallons per day (gpd) or more, the TDR must be one-tenth (0.1) of the DDF, in gallons per minute (gpm):

total discharge rate (TDR) = 0.1 x design daily flow (DDF)

2. For details on the calculation of total dynamic head and requirements for pump selection, see *Chapter 5, Section VIII*.

## IV. Trench Pressure Onsite Systems

In addition to the requirements of *Section I* of this chapter, all of the following provisions must be met to permit the installation and construction of a trench pressure onsite system.

### A. Soil Absorption Trenches

The total soil absorption trench length of a trench pressure onsite system soil absorption field must not exceed two thousand (2,000) feet per pump.

### B. Distribution of Effluent

1. General requirements for manifolds.
   a. A manifold must be installed between the effluent force main and the pressure distribution laterals.
   b. The effluent force main must feed the manifold from the upslope side of the soil absorption field, unless variable hole spacing with a constant diameter manifold is installed.
   c. A manifold must be located:
      1) At the center or end of the laterals for onsite systems with a design daily flow (DDF) of seven hundred fifty (750) gallons per day or less; or
      2) At the center of the laterals for onsite systems with a design daily flow (DDF) of more than seven hundred fifty (750) gallons per day.
   d. A manifold must be connected to the laterals as follows:
      1) For a manifold located at the center of the laterals, the connection to the laterals must be tee-to-tee. The connection of the last downslope laterals to the manifold must be tee to laterals (at the same elevation) to allow the manifold to drain.
      2) For a manifold located at the end of the laterals, the connection to the laterals must be tee-to-elbow, except for the last downslope lateral. The connection of the last downslope lateral to the manifold must be elbow-to-lateral (at the same elevation) to allow the manifold to drain.
   e. Each pressure distribution lateral must connect directly to a manifold.
   f. Backfill around manifolds must be aggregate-free and backfilled in a manner to prevent the movement of effluent along the exterior of the manifold pipe. Pipe integrity must be maintained during backfill and compaction.
2. Requirements for pressure distribution laterals.
   a. Pressure distribution laterals serving soil absorption trenches of different length are allowable.
   b. Pressure distribution laterals must comply with requirements contained in *Chapter 5, Section IX. D., Pressure Distribution Networks* and *Section IX. E., Holes in Pressure Distribution Networks*.
   c. The lateral diameter at the design lateral length and hole spacing is determined from *Figure 5-6, Pressure Distribution Lateral Diameter*.

d. Allowable spacing of holes along pressure distribution laterals is based on the soil loading rate and must be within the range of spacing listed in *Figure 6-6, Range of Hole Spacing for Trench Pressure Onsite Systems*.

**Figure 6-6**
**Range of Hole Spacing for Trench Pressure Onsite Systems**

| SLR (gpd/ft$^2$) | Range of Hole Spacing (ft.) |
|---|---|
| 1.20 | 3[1] |
| 0.75 | 3-5 |
| 0.60 | 3-6 |
| 0.50 | 3-6 |
| 0.30 | 3-7 |
| 0.25 | 3-7 |

[1] Designs using variable hole spacing (VHS) may not be developed for soils having a SLR of 1.20 gpd/ft$^2$.

## C. Constant Diameter Manifold Designs

1. An onsite system with an elevation difference of not more than eight (8) inches between the highest and lowest pressure distribution lateral may use a constant diameter manifold. In such cases, no compensation for differences in static head ($H_s$) between laterals is required.
2. The diameter of the manifold must be determined using *Appendix C, Figure 5-5, Determination of Manifold Diameters*.
3. The design head ($H_D$) of the highest elevation lateral must be three (3) feet.
4. The total discharge rate (TDR) of the pump must be the total number of one-quarter (1/4) inch holes in all laterals times one and twenty-eight hundredths (1.28) gallons per minute (gpm).

## D. Variable Manifold Sizing & Variable Hole Spacing Designs

Variable manifold sizing and variable hole spacing are used to achieve proportionate loading and equal application of effluent to the infiltrative surfaces of soil absorption trenches where differences in elevation between the highest and lowest pressure distribution lateral is greater than eight (8) inches. Variable manifold sizing and variable hole spacing trench pressure onsite systems are complex to design and may require multiple calculations to develop an acceptable design.

1. Authority for variable manifold sizing and variable hole spacing designs.
   a. Residential onsite systems requiring variable manifold sizing or variable hole spacing must be reviewed and released by the department before local health department permit issuance.
   b. Where individual staff of local health departments demonstrate proficiency in the review of residential trench pressure onsite systems using variable manifold sizing and variable hole spacing, the department may delegate plan review and approval in accordance with *410 IAC 6-8.2-42 (c) (3)*.

2. For onsite systems with an elevation difference of more than eight (8) inches between the highest and the lowest pressure distribution lateral, variable manifold sizing or variable hole spacing is required.
3. General requirements for manifolds and pressure distribution laterals are contained in *Sections IV. B. 1*. and *IV. B. 2.,* of this chapter.
4. Requirements for variable manifold sizing designs.
    a. The effluent force main must feed the manifold from the upslope side of the soil absorption field.
    b. Manifold diameter changes must be made between manifold and lateral connections.
    c. The maximum allowable change in manifold diameter between adjacent laterals is: six (6) inch to four (4) inch; four (4) inch to three (3) inch; three (3) inch to two (2) inch; and two (2) inch to one (1) inch.
    d. The maximum velocity of effluent in any section of the manifold is eight (8) feet per second (fps). [Velocity is calculated from v = Q/A, where Q is the flow of effluent in the manifold section (in $ft^3$/sec.) and A is the area of the cross-section of the manifold section (in $ft^2$).]
    e. The spacing of one-quarter (1/4) inch holes in the pressure distribution laterals should be set at the maximum allowable distance acceptable for the soil loading rate (SLR) in *Figure 6-6, Range of Hole Spacing for Trench Pressure Onsite Systems*, to minimize the pump capacity, except where closer hole spacing is necessary where the slope of the soil absorption field site approaches fifteen (15) percent.
    f. If the effluent force main drains to the soil absorption field, the design of the pressure distribution network must provide for the distribution of effluent draining from the effluent force main after the pump turns off.
    g. Requirements for calculating lateral head.
        1) The design head ($H_D$) of the highest elevation lateral must be three (3) feet.
        2) The minimum allowable head for any lateral within the pressure distribution network is two and one-half (2.5) feet.
    h. The design is acceptable when the variation in head between the laterals with the highest and lowest head does not exceed seven-tenths (0.7) feet.
    i. Requirements for calculating total discharge rate (TDR) in gallons per minute (gpm).
        1) Calculate the discharge rate of each lateral at the design head of the lateral ($H_D$) using *Figure 6-7, Discharge Rate (Q) for 1/4" Holes*.
        2) Total each lateral discharge rate to calculate the total discharge rate of the pressure distribution network.
        3) The total discharge rate used for pump selection must be the total discharge rate calculated in the final design.
    j. Variable hole spacing may be used in combination with variable manifold sizing to achieve design requirements. This may be necessary if variable manifold sizing is insufficient to meet the design criteria of *Section IV. D. 4. h*., of this chapter.

| Figure 6-7<br>Discharge Rates (Q) for 1/4" Holes | |
|---|---|
| **Head, $H_D$ (ft.)** | **¼" Hole (gpm)** |
| 2.5 | 1.17 |
| 2.6 | 1.19 |
| 2.7 | 1.21 |
| 2.8 | 1.23 |
| 2.9 | 1.26 |
| 3.0 | 1.28 |
| 3.1 | 1.30 |
| 3.2 | 1.32 |
| 3.3 | 1.34 |
| 3.4 | 1.36 |
| 3.5 | 1.38 |
| 3.6 | 1.40 |
| 3.7 | 1.42 |
| 4.0 | 1.47 |
| 4.5 | 1.56 |

5. Requirements for variable hole spacing designs.
   a. The spacing of one-quarter (1/4) inch holes at the lowest elevation lateral must be the maximum allowable distance acceptable for the soil loading rate (SLR), as shown in *Figure 6-6, Range of Hole Spacing for Trench Pressure Onsite Systems*.
   b. Lateral hole spacing in all remaining laterals must be in one-half (1/2) foot increments (i.e., 3ft., 3.5ft., … 6.5ft., 7ft.).
   c. Variable hole spacing designs may not be used in soils having a soil loading rate of one and twenty hundredths (1.20) gallons per day per square foot ($gpd/ft^2$) within twelve (12) inches of the soil absorption trench bottom. In such cases, the hole spacing must be constant at three (3) feet.
   d. The manifold diameter must be determined using *Appendix C, Figure 5-5, Determination of Manifold Diameters*.
   e. The design head ($H_D$) of the highest elevation lateral must be three (3) feet.
   f. The design head of each lower elevation lateral ($H_D$) is three (3) feet plus the elevation difference, in feet, between the highest elevation lateral and the lower elevation lateral.
   g. The design is acceptable when the volume of effluent supplied to each soil absorption trench does not vary more than ten (10) percent among all trenches as measured in gallons per minute per lineal foot (gpm/lf) of trench.
   h. Requirements for calculating total discharge rate in gallons per minute (gpm).
      1) Total discharge rate (TDR) is the sum of the discharge rates of all laterals in the pressure distribution network.
      2) The discharge rate of each lateral is the sum of the discharge rates of each hole in the lateral at its design head ($H_D$).

a) Discharge rates for one-quarter (1/4) inch holes at typical design heads ($H_D$) are given in *Figure 6-7, Discharge Rates (Q) for 1/4" Holes*.

b) The discharge rate of a hole with other diameters or design heads ($H_D$) are calculated from:

$$Q = 11.8\ d^2 \sqrt{H_D}, \text{ in gpm}$$

where d = the diameter of the hole, in inches.

3) The total discharge rate used for pump selection must be the total discharge rate calculated in the final design iteration.

i. Variable manifold sizing may be used in combination with variable hole spacing to achieve design requirements. This may be necessary if variable hole spacing is insufficient to meet the design criteria of *Section IV. D. 5. g.*, of this chapter.

## E. Dose Volume

See *Figure 6-2, Dose Volume for Flood Dose & Trench Pressure Onsite Systems* for determining dose volume.

## F. Pump Selection

See *Chapter 5, Section VIII., Effluent Pumps,* for details on the calculation of total dynamic head and requirements for pump selection.

# Chapter 7 Sand Mound Onsite Systems

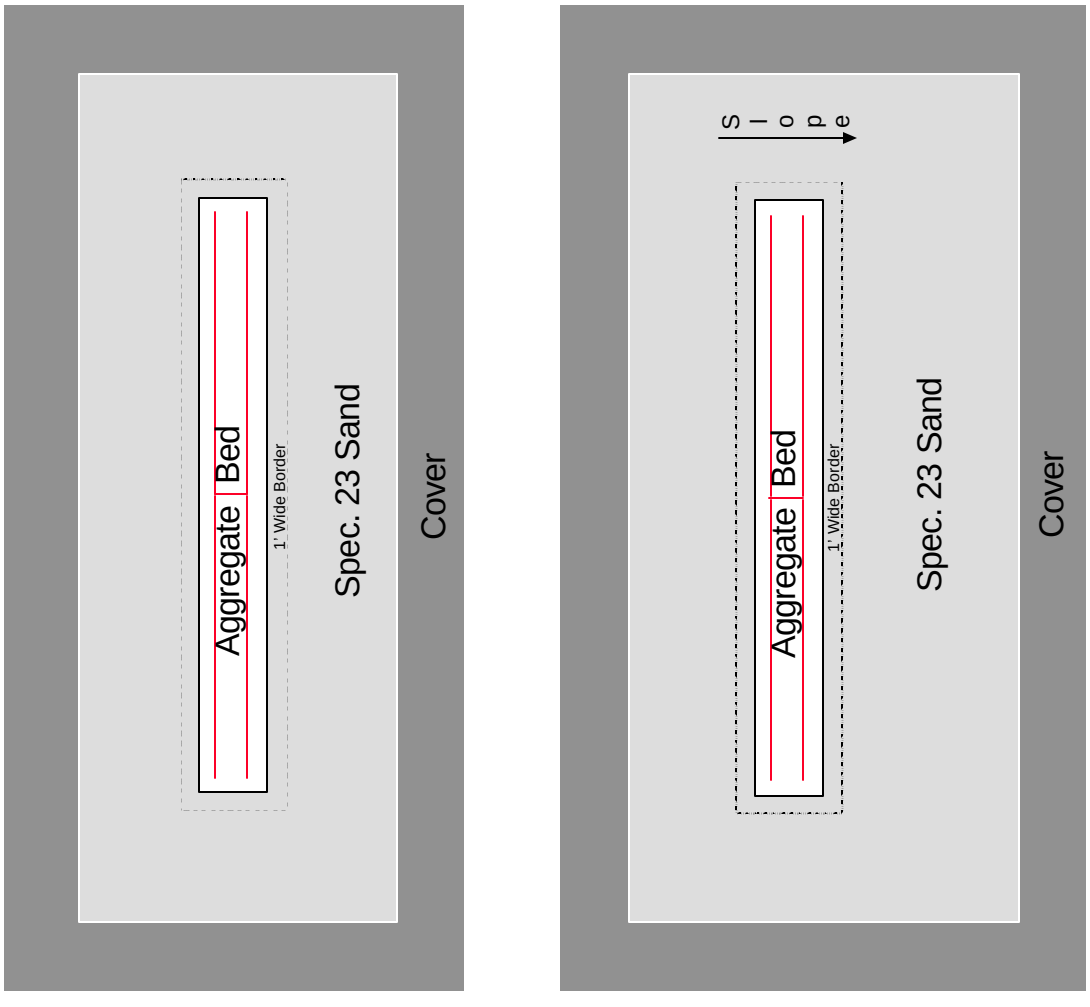
Sand mound OSS may be used to overcome certain site and soil limitations. Care must be exercised in their design, installation and construction.

This chapter provides technical information on the design, installation and construction of sand mound OSS. *In general the dimensions of the sand mound should be as long and narrow as possible*. See *Figure 7-1, Plan View of Sand Mounds* for a general schematic layout of sand mound OSS.

After all of the applicable site and soil conditions of *Chapter* 3 have been met, all of the following provisions must be met to approve the installation and construction of a sand mound OSS.

**Figure 7-1**
**Plan View of Sand Mounds**

| (Slope ≤ 1/2%) | 1/2 % < Slope ≤ 6% |
|---|---|



# I. Installation and Construction of Sand Mound Onsite Systems

Sand mound sites are subject to damage resulting from poor construction techniques. Care must be exercised in sand mound installation and construction. Caution is required during installation and construction of the sand mound, during construction of structures on the site, during removal of trees and excessive vegetation, and during landscaping operations, to prevent damage of the sand mound site and its dispersal area.

## A. Protection of the Sand Mound Site

The soil absorption field site must be protected. The site includes the area selected for placement of the sand mound, dispersal area, and site drainage; the set aside area, when a set aside area is required; and the area(s) designated for future expansion, when needed.

1. Before the start of any construction on the property, the location of the sand mound soil absorption field, dispersal area, site drainage, set aside area (if required), and areas designated for future expansion (if required) must be staked out and protected from disturbance.
2. Site preparation, construction of the sand mound, finish grading and soil stabilization must not be performed when the soil is sufficiently wet to exceed its plastic limit.
    a. Sufficient samples must be evaluated throughout the soil absorption field site to assure that the plastic limit of the soil is not exceeded.
    b. The plastic limit of a soil is exceeded when the soil can be rolled between the palms of the hands to produce threads one-eighth (1/8) inch in diameter that do not easily break apart or crumble.
3. Site preparation, construction of the sand mound, finish grading and soil stabilization must not be performed when the soil is frozen.
4. Site preparation, finish grading and soil stabilization must be performed in accordance with the approved plans.
5. A permit for an onsite system may be revoked in accordance with the requirements of *410 IAC 6-8.2-50 (d) (1)*, for the following:
    a. Alteration of the site, after the written site evaluation report, by the addition of fill, or the cutting, scraping, or removal of soil; or
    b. Compaction of the site, by vehicles or construction equipment before or during construction, resulting in densic materials.

## B. Installation of the Effluent Force Main

1. Before tilling the sand mound site:
    a. The effluent force main from the dose tank to the basal area must be installed to a depth of at least sixteen (16) inches below existing grade; and
    b. The end of the effluent force main must be fitted with a temporary vertical pipe extending at least three (3) feet above grade and capped.
2. If the effluent force main does not drain back to the dose tank, it must be:
    a. Installed below the frost line (see *Figure 6-1, Frost Penetrations in Indiana)*; and

b. Designed so that no effluent remains in any portion of the effluent force main located above the frost line.

3. Backfill around the effluent force main must be:
   a. Debris–free soil material; and
   b. Backfilled in a manner to prevent movement of effluent along the exterior of the effluent force main.
4. Pipe integrity must be maintained during backfill.

C. Preparation of the Sand Mound Site

1. Excessive vegetation at the sand mound site must be cut and removed (not scraped or scalped) without causing densic materials.
2. If trees are present within the proposed sand mound site:
   a. Trees must be cut off at ground level and the stumps left in place; and
   b. Roots that protrude above the tilled surface must be cut off without causing densic material.
3. The portion of the sand mound site receiving Spec. 23 sand must be tilled to a depth of seven (7) to fourteen (14) inches with a moldboard plow, chisel plow, or backhoe. Tilling must be parallel to the contour of the site. The department or local health department may require field supervision of tilling operations.
   a. For wooded sites:
      1) The trees must be cut off at the ground surface and removed, with only stumps left in place; and
      2) A backhoe must be used to till the site and be approved, in writing, by the department or local health department.
         a) Tilling must be performed parallel to the contour of the site.
         b) The backhoe bucket must be fitted with chisel teeth.
         c) The surface of the ground must be tilled with the backhoe bucket causing minimal disturbance to tree roots.
         d) The backhoe must remain on untilled soil.
   b. For non-wooded sites:
      1) If a chisel plow is used, only one pass must be made across the site parallel to the contour of the site.
      2) If a moldboard plow is used:
         a) It must have at least two (2) bottoms and make only one pass across the area, parallel to the contour of the site; and
         b) On sites with slopes greater than one-half (1/2) percent, the furrows must be turned upslope.
      3) The use of a backhoe must be approved, in writing, by the department or local health department.
         a) Tilling must be performed parallel to the contour of the site.
         b) The backhoe bucket must be fitted with chisel teeth.
         c) The surface of the ground must be tilled with the backhoe bucket.
         d) The backhoe must remain on untilled soil.

c. If a plow pan or densic material is identified in the soil profile report, tilling of the soil must be to a depth of at least four (4) inches below the bottom of the plow pan or densic material.

D. Construction of the Basal Area

1. The basal area must be covered using sand that meets the requirements of the *Indiana Department of Transportation Specification 23* [see *Figure 7-2, INDOT Specification 23 (Spec. 23) Sand*].
2. Spec. 23 sand must be placed on the tilled area immediately after tilling the site to protect the tilled surfaces from damage by precipitation.
3. The depth of the Spec. 23 sand under the aggregate bed must be at least twelve (12) inches. [For sites with slopes greater than one-half (1/2) percent, the depth of Spec. 23 sand beneath the downslope side of the aggregate bed will be greater than twelve (12) inches.]
4. Spec. 23 sand must be placed on the tilled surface as follows:
   a. On sites with slopes one-half (1/2) percent or less, from the ends of the sand mound; and
   b. On sites with slopes greater than one-half (1/2) percent, from the ends or upslope edge.
5. At least six (6) inches of Spec. 23 sand must be kept between the vehicle wheels or tracks and the tilled soil of the site.
6. The depth of Spec. 23 sand around the aggregate bed is the sum of:
   a. The depth of the sand under the aggregate bed; and
   b. The depth of the aggregate bed.
7. A one (1) foot wide border of Spec. 23 sand must surround the aggregate bed, level with the top of the aggregate bed.

**Figure 7-2**
**INDOT* Specification 23 (Spec. 23) Sand**

| Sieve Sizes | | Percent (%) Passing Sieve (by Weight) |
|---|---|---|
| 3/8 in | (9.50 mm) | 100 |
| No.4 | (4.75 mm) | 95 – 100 |
| No. 8 | (2.36 mm) | 80 – 100 |
| No. 16 | (1.18 mm) | 50 – 85 |
| No. 30 | (600 μm) | 25 – 60 |
| No. 50 | (300 μm) | 5 – 30 |
| No. 100 | (150 μm) | 0 – 10 |
| No. 200 | (75 μm) | 0 – 3 |

* INDOT: Indiana Department of Transportation. The sand must not have more than forty-five (45) percent retained between any two (2) consecutive sieves.

## E. Construction of the Aggregate Bed

1. The surface of the Spec. 23 sand at the sand/aggregate interface must be smooth and free of footprints, ruts, and depressions before the placement of the aggregate.
2. The depth of aggregate must be:
   a. At least six (6) inches below the pressure distribution lateral; and
   b. At least two (2) inches above the pressure distribution lateral.
3. The aggregate bed must be covered with a barrier material (*see Chapter 5, Section X. B. 2.*). The barrier material must cover the aggregate bed from side-to-side and from end-to-end.
4. Requirements for pressure distribution lateral design are contained in *Chapter 5,.Section IX. D. and E. and Section II. C. 4.* of this chapter.

## F. Placement of Soil Material Cover & Final Grade

1. Prior to the placement of the soil material cover:
   a. Prepare the ground surface along the perimeter of the Spec. 23 sand by tilling to a depth of seven (7) to fourteen (14) inches with a moldboard plow, chisel plow, or backhoe.
      1) Tilling must be parallel to the contour of the site.
      2) Tilling operations that comply with *Section I. C.* of this chapter.
   b. Prepare the surface of the Spec. 23 sand before the placement of soil material cover:
      1) Maintaining at least a minimum grade of three-to-one (3:1); and
      2) Preparing the surface of the Spec. 23 sand so that it is smooth and free of footprints, ruts, and depressions.
2. Soil material cover must be used for protection of the sand mound.
   a. The soil material cover must be:
      1) A soil with a texture other than sand or loamy sand;
      2) Capable of sustaining plant growth; and
      3) Placed on the Spec. 23 sand without causing compaction resulting in densic material.
   b. The aggregate and sand of the sand mound must be covered with a minimum of twelve (12) inches of soil material.
   c. A minimum of an additional six (6) inches of a soil material must be placed over the center line of the long axis of the aggregate bed and crowned to promote surface runoff from the onsite system.
   d. Soil material must be placed on the tilled portion of the sand perimeter and graded according to the requirements of *Section I. C. 3.* of this chapter.
   e. The soil material cover must have a final grade on all sides of at least three-to-one (3:1).
3. The sand mound must be seeded or sodded with grasses adapted to the area. If seeded, the sand mound must be protected by a cover of straw, burlap, or some other biodegradable material that will protect it against erosion.

## II. Design of a Sand Mound Onsite System

### A. Design of the Aggregate Bed

1. General aggregate bed design.
   a. Aggregate used in the aggregate bed must comply with the requirements of *Chapter 5, Section XI. B., Specifications, Aggregate*.
   b. The aggregate bed must be installed in INDOT Spec. 23 sand in the basal area (see *Figure 7-5, Specification 23 Sand* of this chapter).
   c. A one (1) foot wide border of Spec. 23 sand, level with the top of the aggregate bed, must surround the aggregate bed.
   d. The long axis of the aggregate bed must be oriented parallel to the contours of the absorption area site.
   e. The bottom of the aggregate bed must be level along its length and width.
2. Dimensions of the aggregate bed.

   The dimensions of the aggregate bed should be as long and narrow as possible.

   a. The minimum area of the aggregate bed is:

$$\text{aggregate bed area } (ft^2) = \frac{\text{DDF (gpd)}}{1.2 \text{ gpd/ } ft^2},$$

   (see *Chapter 5, Section I, Daily Design Flow (DDF) of Sewage*).

   b. Requirements for aggregate bed width.
      1) The maximum width of the aggregate bed (in feet), is:

$$\text{Maximum width} = 0.83 \text{ } ft^2/\text{gpd} \sqrt{\frac{\text{DDF (gpd) x SLR (gpd/ } ft^2)}{n}},$$

      rounded down to the nearest whole number, and

      where:

| DDF | n |
|---|---|
| ≤ 1500 gpd | 3 |
| 1501 – 3000 gpd | 4 |
| 3001 – 4000 gpd | 5 |

      See *Figure 7-3, Aggregate Bed Dimension*, for typical aggregate bed dimensions for residences using the maximum width formula.

      2) For OSS with a design daily flow (DDF) of seven-hundred and fifty (750) gallons per day or less, the width of the aggregate bed must be at least four (4) feet and no greater than ten (10) feet. If more than one aggregate bed is constructed, each aggregate bed must be equal in area.
      3) For OSS with a design daily flow (DDF) of greater than seven-hundred and fifty (750) gallons per day:
         a) If the soil loading rate (SLR) is fifty-hundredths (0.50) gallons per day per square foot (gpd/$ft^2$) or less, the width of the aggregate bed must be no greater than fifteen (15) feet.

b) If the soil loading rate (SLR) is greater than fifty-hundredths (0.50) gallons per day per square foot (gpd/ft$^2$), the width of the aggregate bed must be no greater than twenty (20) feet.

**Figure 7-3**
**Aggregate Bed Dimension**
**(Based on Maximum Width Formula)[1]**

| DDF (gpd) | Aggregate Bed Area (ft$^2$) | SLR (gpd/ft$^2$) | Maximum Width[2] (ft) | Minimum Length[3] (ft) |
|---|---|---|---|---|
| 150 | 125 | 0.25 | 4 | 32 |
| | | 0.50 | 4 | 32 |
| | | 0.60 | 5 | 25 |
| | | 1.20 | 6 | 21 |
| 300 | 250 | 0.25 | 4 | 63 |
| | | 0.50 | 6 | 42 |
| | | 0.60 | 6 | 42 |
| | | 1.20 | 9 | 28 |
| 450 | 375 | 0.25 | 5 | 75 |
| | | 0.50 | 7 | 54 |
| | | 0.60 | 8 | 47 |
| | | 1.20 | 10 | 38 |
| 600 | 500 | 0.25 | 6 | 84 |
| | | 0.50 | 8 | 63 |
| | | 0.60 | 9 | 56 |
| | | 1.20 | 10 | 50 |
| 750 | 625 | 0.25 | 7 | 90 |
| | | 0.50 | 9 | 70 |
| | | 0.60 | 10 | 63 |
| | | 1.20 | 10 | 63 |
| 900 | 750 | 0.25 | 7 | 107 |
| | | 0.50 | 10 | 75 |
| | | 0.60 | 11 | 69 |
| | | 1.20 | 16 | 47 |

[1] The dimensions of the sand mound should be designed as long and narrow as possible.

[2] Rounded down to the nearest whole number, with the following maximums:

- Ten (10) feet for sand mounds with DDF $\leq$ 750 gpd;
- Fifteen (15) feet for sand mounds with DDF > 750 gpd and SLR $\leq$ 0.50 gpd/ft$^2$;
- Twenty (20) feet for sand mounds with DDF > 750 gpd and SLR > 0.50 gpd/ft$^2$.

[3] Rounded up to the nearest whole number.

c. The length of the aggregate bed is:

length (L) = aggregate bed area / aggregate bed width (AB).

d. The minimum depth of the aggregate bed is twelve (12) inches, with:
   1) At least 6 inches below the pressure distribution lateral; and
   2) At least 2 inches above the pressure distribution lateral.

3. Location of the aggregate bed.
   a. For sites with slopes of one-half (1/2) percent or less, the aggregate bed must be located in the center of the basal area.
   b. For sites with slopes greater than one-half (1/2) and less than or equal to six (6) percent, the aggregate bed must be located at the upslope side of the basal area.
   c. See *Figure 7-4, Plan View of Sand Mound (Based on Minimum Dimensions)*, for a visual depiction of the location of the aggregate bed within the basal area.

## B. Design of the Basal Area & Sand Mound

Numerical dimensions provided as examples in this section for basal area size are rounded up to the nearest whole number, providing side slope grades slightly greater than three-to-one (3:1). Numerical dimensions for the soil material cover from the edge of the basal area to the edge of the sand mound are based on a final grade of three-to-one (3:1) (on level sites). The plan views and numerical dimensions provided in this chapter are for a simple slope (i.e., slopes that form a plane). Sand mounds sited on complex slopes are more difficult to design and construct on contour.

The "foot print" or total area needed at a site for an elevated sand mound is determined by following the design requirements that begin in *Section II, A.* and continue through *Section II, B. 4.* of this chapter.

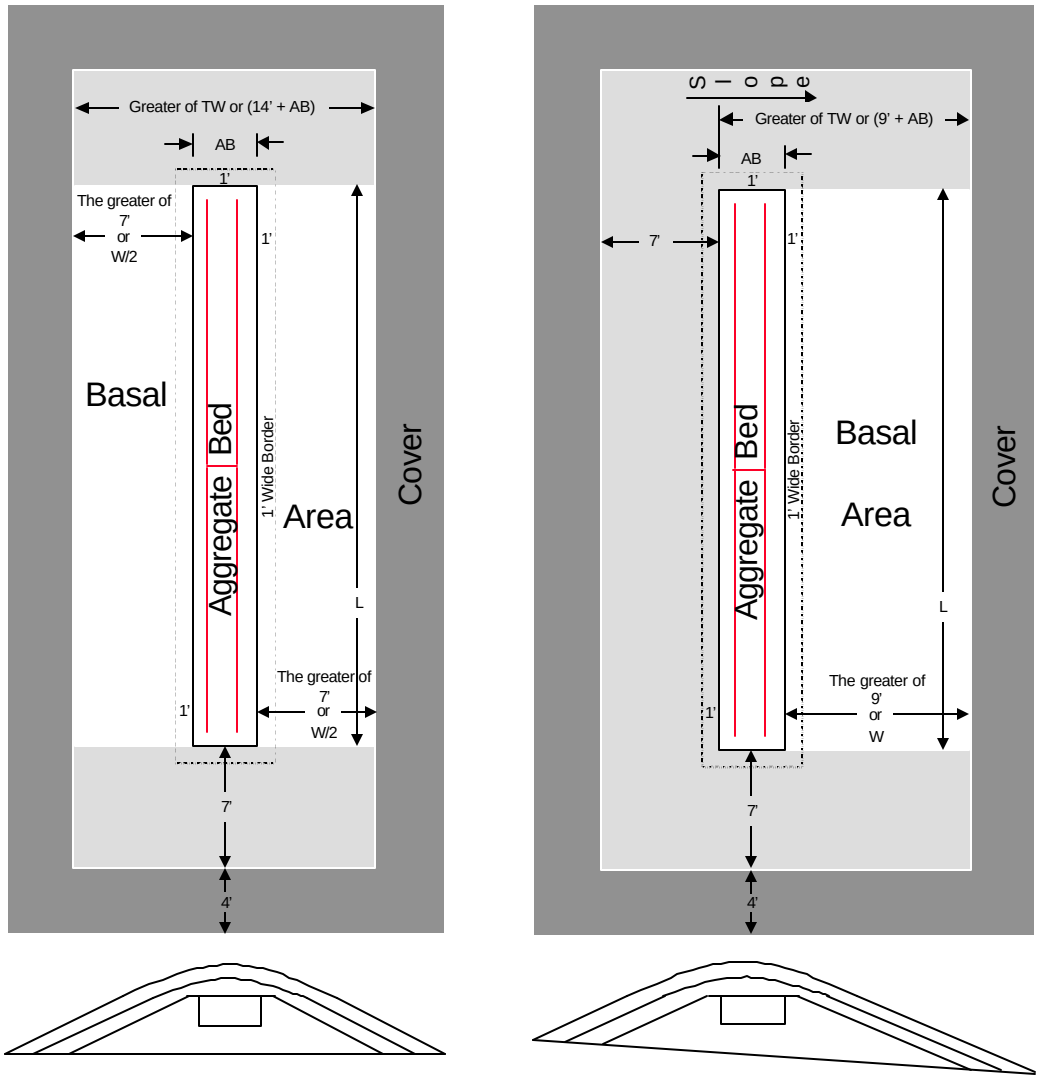
1. General design of basal area and sand mound.
   a. Design must be based on the following:
      1) Sites with slopes one-half (1/2) percent or less;
      2) Sites with slopes greater than one-half (1/2) and less than or equal to six (6) percent.
   b. The basal area/sand mound must be constructed on the tilled surface of the absorption field.
   c. The long axis of the basal area/sand mound must be oriented parallel to the contour of the absorption field site.
   d. The minimum depth of the Spec. 23 sand under the aggregate bed must be twelve (12) inches.
   e. The Spec. 23 sand must have a final grade on all sides of at least three-to-one (3:1).
   f. The soil material cover must have a final grade on all sides of at least three-to-one (3:1).

2. Basal area size and location.
   a. The minimum size of the basal area must be based on the following:

$$\text{Basal area } (ft^2) = \frac{\text{design daily flow}}{\text{soil loading rate}} = \frac{\text{DDF (gpd)}}{\text{SLR (gpd/ ft}^2\text{)}}$$

**Figure 7-4**
**Plan View of Sand Mound**
**(Based on Minimum Dimensions)**

| (Slope ≤ 1/2%) | (1/2% < Slope ≤ 6%) |
|---|---|




Legend: L = length; TW = total width of basal area; AB = width of aggregate bed
W = width (TW - AB); W/2 = ([TW - AB] / 2)

1) In this computation, the soil loading rate (SLR) used must be that of the most restrictive horizon from all detailed soil profile descriptions evaluated for the soil absorption field. The soil loading rate must be of the most restrictive horizon within twenty (20) inches of original grade.
2) Soil loading rates must be determined using *Appendix C, Figure 3-4, Soil Loading Rates* for OSS.

b. The length (L) of the basal area equals the length of the aggregate bed.

c. The location of the basal area within the sand mound must be as follows:
   1) On sites with slopes of one-half (1/2) percent or less, the area under the aggregate bed and extending an equal distance from each side along the length of the aggregate bed.
   2) On sites with slopes greater than one-half (1/2) percent and less than or equal to six (6) percent, the area under the aggregate bed and extending downslope from the aggregate bed.
   3) See *Figure 7-3, Plan View of Sand Mound (Based on Minimum Dimensions)*, for a visual depiction of the location of the basal area within the sand mound.

d. For the calculation of the total width of the basal area (TW), the following terms are used:

   L = length of aggregate bed

   TW (total width of basal area) = basal area / L

   AB = width of aggregate bed

   W (total width of basal area minus width of aggregate bed) = TW – AB

   $$W/2 \left(\begin{array}{l}\text{width of basal area on either side of}\\ \text{aggregate bed on sites with slopes} \leq 1/2\%\end{array}\right) = \frac{TW-AB}{2}$$

e. On sites with slopes not exceeding one-half (1/2) percent, the minimum width of the basal area is the sum of the following:
   1) The width of the aggregate bed (AB);
   2) Plus the greater of either:
      a) The total width of basal area minus the width of aggregate bed (W = TW – AB), or
      b) Fourteen (14) feet.
      c) The dimension from *Section II. B. 2. e. 1) or 2)* must maintain a sideslope grade of at least three-to-one (3:1). It represents the Spec. 23 sand equally divided on both sides of the aggregate bed

f. On sites with slopes greater than one-half (1/2) percent and less than or equal to six (6) percent, the minimum width of the basal area is the sum of the following:
   1) The width of the aggregate bed (AB);
   2) Plus the greater of either:
      a) The total width of basal area minus the width of aggregate bed (W = TW – AB), or
      b) Nine (9) feet.
      c) The dimension from *Section II. B. 2. f. 1) or 2)* must maintain a sideslope grade of at least three-to-one (3:1). It represents the Spec. 23 sand on the downslope side of the aggregate bed

3. Sand Mound Length

The minimum length of a sand mound is the sum of the following:

a. The length of the aggregate bed (L);
b. Plus fourteen (14) feet, representing the two side-slopes of Spec. 23 sand at both ends of the aggregate bed [including the one (1) foot level

borders], and must maintain a sideslope grade of at least three-to-one (3:1);

c. Plus six (6) feet, representing the soil material cover at both ends of the aggregate bed.

4. Sand mound width.

a. On sites with slopes less than or equal to one-half (1/2) percent, the minimum width of a sand mound is the sum of the following:

1) The width of the aggregate bed (AB);

2) Plus the greater of either:

a) The total width of basal area minus the width of aggregate bed (W = TW – AB), or

b) Fourteen (14) feet.

c) The dimension from *Section II. B. 4. a. 1) or 2)* must maintain a sideslope grade of at least three-to-one (3:1).

3) Plus six (6) feet, representing the soil material cover on both sides of the aggregate bed.

b. On sites with slopes greater than one-half (1/2) percent and less than or equal to six (6) percent, the minimum width of a sand mound is the sum of the following:

1) The width of the aggregate bed (AB);

2) Plus seven (7) feet, representing the side-slope of Spec. 23 sand on the upslope side of the aggregate bed [including the one (1) foot level border], and must maintain a sideslope grade of at least three-to-one (3:1);

3) Plus the greater of either:

a) The total width of basal area minus the width of aggregate bed (W = TW – AB), or

b) Nine (9) feet.

c) The dimension from *Section II. B. 4. b. 3) a) or b)* must maintain a sideslope grade of at least three-to-one (3:1).

4) Plus six (6) feet, representing the soil material cover on both sides of the aggregate bed.

## C. Design of the Pressure Distribution Network

1. Effluent force main requirements.

a. For material specifications and sizing requirements for effluent force mains, see *Chapter 5, Section II. B. 3*.

b. Approach of the effluent force main to the sand mound:

1) On sites with slopes of one half (1/2) percent or less, from either end.

2) On sites with slopes greater than one half (1/2) percent and less than or equal to six (6) percent, from the upslope side.

2. Dose volume.

a. If the effluent force main and manifold do not drain to the dose tank, the encapsulated float level controls for the pressure distribution network must be set to deliver one-quarter (1/4) of the design daily flow (Dose = 1/4 DDF).

b. If the effluent force main and manifold drain to the dose tank, the encapsulated float level controls for the pressure distribution network must be set to deliver one-quarter (1/4) of the design daily flow (DDF) plus the volumes of the effluent force main (Dose = 1/4 DDF + $Vol_{FM}$).

3. Manifold(s) requirements.
   a. For material specifications and standards for manifolds, see *Chapter 5, Section II. B. 4*.
   b. A manifold must be installed between the effluent force main and the pressure distribution laterals.
   c. Each pressure distribution lateral must connect directly to the manifold.
   d. The manifold pipe must have the same diameter as the effluent force main, or a diameter of two (2) inches, whichever is greater.
   e. The manifold must be center feed.

4. Pressure distribution laterals requirements.

   Requirements for design of pressure distribution networks are contained in *Chapter 5, Section IX. D. and E*.
   a. The diameter of the pressure distribution laterals must be determined from *Figure 7-5, Pressure Distribution Lateral Diameter for Sand Mounds*.
   b. Holes in pressure distribution laterals must be one-quarter (1/4) inch in diameter and spaced at three (3) feet on centers.
   c. Pressure distribution laterals must be laid out as shown in *Figure 7-6, Plan View of Pressure Distribution Laterals in an Aggregate Bed of a Sand Mound*.
      1) The separation distance between laterals must be twenty-four (24) to thirty-six (36) inches.
      2) Laterals must be located twelve (12) to eighteen (18) inches from the sides of the aggregate bed along the length of the lateral, and eighteen (18) inches from the ends of the aggregate bed.

**Figure 7-5**
**Pressure Distribution Lateral Diameter for Sand Mounds ***

| Lateral Length, L (ft.) | L ≤ 25 ft. | 25 ft. < L ≤ 40 ft. | 40 ft. < L ≤ 55 ft. |
|---|---|---|---|
| Diameter (in.) | 1 in. | 1 1/4 in. | 1 ½ in. |

* Distribution lateral diameters for ¼ in. holes spaced at 3 ft. on centers.

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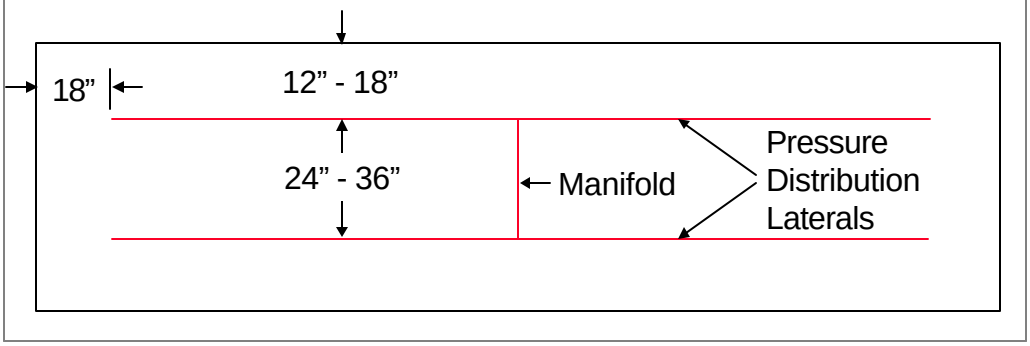
**Figure 7-6**
**Plan View of Pressure Distribution Laterals in an Aggregate Bed of a Sand Mound**

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# Chapter 8 Experimental and Alternative Technologies

This chapter provides technical requirements on the design, operation and maintenance, and performance monitoring of experimental and alternative technologies. Experimental and alternative technologies include secondary treatment devices, high strength waste devices, and experimental or alternative technology soil absorption fields.

Throughout this chapter, the term secondary treatment device applies to a manufactured secondary treatment device and an individually designed secondary treatment device. Secondary treatment devices provide aerobic treatment of sewage effluent and reduce biochemical oxygen demand ($BOD_5$), total suspended solids (TSS), and, when built into the design, total nitrogen (TN). Each of these values is typically expressed in milligrams per liter (mg/L). High strength waste devices reduce $BOD_5$ and TSS to levels that are appropriate for further treatment by a secondary treatment device or for discharge to a soil absorption field.

## I. General Requirements

A. Requirements for onsite systems containing experimental and alternative technology.

1. All experimental technology must comply with the requirements of *410 IAC 6-8.2-53* and be approved by the department.
2. All alternative technology must comply with the requirements of *410 IAC 6-8.2-54* and be approved by the department.
3. A local health department [*410 IAC 6-8.2-46(h)*] may not permit the construction of a new, repair, or replacement experimental or alternative technology onsite system without the written approval of the department, unless authority for plan review and approval is delegated to the local health department under *410 IAC 6-8.2-42(c)(2)*.

B. Bypassing, removing, or excluding any component or components of an experimental or alternative technology after the design has received final approval from the department or local health department, whichever has authority, is prohibited.

C. The concentration of septic tank effluent for $BOD_5$ and TSS must be two–hundred and fifty (250) mg/L or less for discharge into a secondary treatment device.

D. A high strength waste device must be included in onsite systems for commercial facilities when:

1. The septic tank effluent quality is greater than two-hundred and fifty (250) mg/L for $BOD_5$ or TSS;
2. The septic tank effluent quality is greater than twenty-five (25) mg/L for FOG; or
3. Greater than fifty (50) percent of wastewater generated is from food operations or food production.

E. The concentration from a high strength waste device must be reduced to two-hundred and fifty (250) mg/L or less for $BOD_5$ and TSS, and twenty-five (25) mg/L or less for FOG, prior to discharge to:

1. A soil absorption field; or
2. An experimental or alternative technology secondary treatment device.

F. Design requirements for secondary treatment devices and high strength waste devices.

1. Effluent from a secondary treatment device and a high strength waste device is partially treated sewage.
   a. Effluent from a secondary treatment device must discharge into a soil absorption field with no outlet, or a dose tank that discharges into a soil absorption field with no outlet.
   b. Effluent from a high strength waste device must discharge into a secondary treatment device, a soil absorption field with no outlet, or a dose tank that discharges into a soil absorption field with no outlet.
2. All secondary treatment devices, except as provided for in *Section I. G. 3. a*. of this chapter, must be preceded by a septic tank with an outlet filter, as required in *Chapter 5, Section IV. G., Septic Tanks*.
3. All secondary treatment devices must be designed to:
   a. Stabilize microorganism colonies during periods when a residence or commercial facility is generating surge flows of sewage; and
   b. Minimize the die-off of microorganisms during periods when a residence or commercial facility is not generating sewage.
4. All recirculating media filters must have a recirculating, process, or treatment tank.
   a. The recirculating, process, or treatment tank must:
      1) Have a capacity of at least one-third (1/3) design daily flow (DDF) between the high and low level float overrides; and
      2) Have a capacity of at least one-third (1/3) design daily flow (DDF) above the high level float override.
   b. If the high level float in a recirculating, process, or treatment tank is activated, the recirculating frequency must be increased up to twice the normal frequency until the high effluent level condition is eliminated.
5. The minimum size of a soil absorption field must comply with:
   a. *Figure 8-1, Effluent Quality for Discharge to a Soil Absorption Field* for soil absorption fields described in *Chapters 6 and 7* of this document.
   b. Requirements of the department for soil absorption fields not described in the *Technical Specification for Onsite Sewage Systems, 2003 Edition*.

G. Aerobic Treatment Units

1. Aerobic treatment units for aerobic digestion must conform to *ANSI/NSF Standard 40, Residential Wastewater Treatment Systems,* and must provide a minimum aerobic treatment capacity equivalent to the design daily flow (DDF) for the OSS.
2. Aerobic treatment units must comply with the requirements of *Chapter 5, Section VI, Connectors, Quality Control, Product Marking & Standards for Tank Installation.*
3. Aerobic treatment units must be:

a. Preceded by a septic tank, or a pretreatment tank approved by the department; and
b. Followed by an outlet filter, as required in *Chapter 5, Section IV. G., Requirements for Outlet Filters*.

**Figure 8-1**
**Effluent Quality[1] for Discharge to a Soil Absorption Field**

| | $BOD_5$ | TSS | FOG | Reduction Factor[2] | |
|---|---|---|---|---|---|
| | | | | SLR ≤ 0.30gpd/ft² | SLR ≥ 0.50gpd/ft² |
| Without secondary treatment device or with high strength waste device | ≤ 250 | ≤ 250 | ≤ 25 | 0 | 0 |
| With secondary treatment device | ≤ 30 | ≤ 30 | ≤ 25 | 1/3 | 1/2 |

[1] Effluent quality discharged to the soil absorption field, measured in milligrams per liter (mg/L).
[2] Proportion a soil absorption field described in the *Technical Specification for Onsite Sewage Systems, 2003Edition* may be reduced in size.
Terms: $BOD_5$—biochemical oxygen demand; TSS—total suspended solids; FOG—fats, oils, and grease.

# II. Operation & Maintenance (O&M)

## A. General Requirements

1. The requirements of *Sections II. and III.* of this chapter apply only to onsite systems designated in *Section II. A. 2.* of this chapter.
2. O&M is required for:
   a. All secondary treatment and high strength waste devices; and
   b. As required by the department, experimental and alternative technology soil absorption fields.
3. O&M must be performed at least once every six (6) months.
4. The owner must maintain an O&M contract for the life of a secondary treatment device, high strength waste device, and experimental or alternative technology soil absorption field for which the department requires O&M, in accordance with:
   a. The manufacturer's or designer's requirements, whichever is applicable; and
   b. The designer's requirements for experimental or alternative technology soil absorption field for which the department requires O&M.
5. The owner must provide the department or local health department, whichever has jurisdiction, with evidence:
   a. Of an O&M contract; and
   b. That all scheduled inspection and maintenance is performed within two months of the date required for inspection and maintenance.

6. In addition to the information required in *Chapter 2, Administrative Authority & Plan Submittal*, the owner or owner's agent must provide the department or local health department, whichever has jurisdiction, the following information:
    a. A complete O&M schedule with frequencies for maintenance;
    b. Manufacturer or designer, model number or product identification, and specifications for all equipment, products, and materials used in a secondary treatment device and high strength waste device; and
    c. Designer and specifications for all equipment, products, and materials used in an experimental or alternative technology soil absorption field for which the department requires O&M.
7. The authorized representative of the manufacturer, as defined in *Chapter 8, Section II. B. 1.* of this document, or designer, of a secondary treatment device, high strength waste device, and experimental or alternative technology soil absorption field must provide the owner, in writing, the following:
    a. Notification that the onsite system contains an experimental or alternative technology. The owner must sign receipt for this notification, and a copy of the receipt must be included in the plan submittal.
    b. Notification of requirement for the O&M of the experimental or alternative technology. The owner must sign receipt for this notification, and a copy of the receipt must be included in the plan submittal. This notification must include:
        1) Requirement that the owner must maintain an O&M contract for the life of the experimental or alternative technology.
        2) Requirement that the owner must provide the department or local health department, whichever has jurisdiction, with information on the O&M contract as required in *Section II. A. 5.* of this chapter.
8. The owner must be provided an O&M manual from an authorized representative of the manufacturer, as defined in *Chapter 8, Section II. B. 1.* of this document, or designer, before a secondary treatment device, high strength waste device, and experimental or alternative technology soil absorption field for which the department requires O&M commences operation. The following information must be included in the O&M manual:
    a. As-built drawings and specifications of the experimental or alternative onsite system;
    b. A complete O&M schedule with frequencies for maintenance;
    c. Manufacturer or designer, model number or product identification, and specifications for all equipment, products, and materials used in a secondary treatment device and high strength waste device;
    d. Designer and specifications for all equipment, products, and materials used in an experimental or alternative technology soil absorption field for which the department requires O&M; and
    e. A statement of inspection verifying:
        1) Proper construction of the onsite system as required in *410 IAC 6-8.2-49, Inspections*; and
        2) Proper start-up operation of the secondary treatment device, high strength waste device, and experimental or alternative technology soil absorption field.

## B. Requirements for Manufacturers, Designers, Installers, and Service Representatives Providing O&M

1. Authorized representatives of the manufacturer (hereinafter, manufacturer agents) include manufacturer distributors and manufacturer representatives.
2. Manufacturer agents must perform all of the following to authorize designers, installers, and service representatives:
    a. Train:
        1) Potential designers on the design, installation, and service of experimental and alternative technology onsite systems;
        2) Potential installers on the installation of experimental and alternative technology onsite systems; and
        3) Potential service representatives on the maintenance of experimental and alternative technology onsite systems.
    b. Oversee, in the field:
        1) At least the first 3 experimental and alternative technology onsite system installations of each installer; and
        2) At least the first 3 experimental and alternative technology onsite system maintenance visits of each service representative.
    c. Provide written documentation, to the department, of the competence and quality of work of all installers, and service representatives, by observed performance, before authorizing:
        1) Installers to install experimental and alternative technology onsite systems; and
        2) Service representatives to provide service on experimental and alternative technology onsite systems.
    d. After meeting the requirements of *Chapter 8, Section II. B. 2. a., b., and c.*, maintain ongoing agreements with:
        1) Each installer authorized to install experimental and alternative technology onsite systems; and
        2) Each service representative authorized to provide service on experimental and alternative technology onsite systems.
    e. Provide the department, and keep up-to-date, a list of:
        1) All designers that have been trained; and
        2) All installers and service representatives under current agreement.
3. Designers must:
    a. Ensure the design of experimental and alternative technology onsite systems are designed in accordance with the requirements of the department and manufacturer.
    b. Register all components to be specified in their experimental and alternative technology onsite systems designs with the department; and
    c. Specify components that are wastewater grade.
4. Authorized installers must:
    a. Be in training or under agreement with a manufacturer agent of an experimental or alternative technology onsite system;
    b. Ensure the installation of experimental and alternative technology onsite system is in accordance with the approved plans;

c. Use experimental and alternative technology onsite system components as shown on the approved plans; and

d. Have a supervisor, authorized by a manufacturer agent, on site during the entire installation of an experimental or alternative technology onsite system.

5. Authorized service representatives must:

a. Be in training or under agreement with a manufacturer agent of an experimental or alternative technology onsite system;

b. Verify all experimental and alternative technology onsite system components are in place in accordance with the approved plans;

c. Ensure all maintenance work on experimental and alternative technology onsite systems in accordance with the O&M manual of the manufacturer agent and designer; and

d. Use experimental and alternative technology onsite system components as shown on the approved plans.

6. Only authorized service representatives may provide maintenance service on experimental and alternative technology onsite systems.

## C. O&M Documentation for Manufactured Experimental and Alternative Technology

1. An owner manual, prepared by a manufacturer of an experimental or alternative technology, must accompany each onsite system containing experimental or alternative technology. A manufacturer agent, authorized designer, or authorized installer, must provide the manual to the owner prior to installation of the experimental or alternative technology. The owner manual must contain the following:

a. Manufacturer, model number or product identification, and power requirements of the experimental or alternative technology.

b. Description of the functional operation of the experimental or alternative technology with diagrams illustrating basic system design and the flow of effluent.

c. Comprehensive operating instructions, including:

1) Operating responsibilities of the owner and proper function of the experimental or alternative technology;

2) Requirements for stable operation, including a list of household substances that, if discharged to the experimental or alternative technology, may adversely affect the experimental or alternative technology, its process (es), or the soil absorption field;

3) Procedures to identify malfunction or operating problems with the experimental or alternative technology; and

4) Actions necessary if the experimental or alternative technology is:

a) Used intermittently; and

b) Not used for extended periods.

d. Description of the requirements for an O&M contract, including:

1) Inspection and maintenance by an authorized service representative;

2) Schedule of required inspection and maintenance;

3) A written report of the results of the required inspection and maintenance; and

4) Names, addresses and telephone numbers of authorized service representatives.

e. As-built drawings and specifications for:
   1) Individually designed secondary treatment devices; and
   2) Experimental and alternative technology soil absorption fields.

f. A statement of inspection of the experimental or alternative technology verifying proper construction and operation according to the approved plan submittal, including flow measurements and pressure readings at the start-up of the experimental or alternative technology.

2. A manufacturer of an experimental or alternative technology must provide comprehensive and detailed design and installation manuals to authorized designers, authorized installers, and authorized service representatives. The design and installation manual must contain, as applicable, the following:
   a. Manufacturer, model number or product identification.
   b. Experimental or alternative technology information, including:
      1) A numbered list of experimental or alternative technology components and an illustration in which all components are identified;
      2) Specifications for all equipment and materials used in the construction of the experimental or alternative technology; and
      3) Wiring schematics for electrical components of the experimental or alternative technology.
   c. Installation instructions, including:
      1) A process overview of the function of each component and the proper function of the experimental or alternative technology when assembled and operating;
      2) Off-loading and unpacking instructions, including:
         a) Safety considerations;
         b) Identification of fragile components; and
         c) Measures to be taken to avoid damage to the experimental or alternative technology;
      3) Sequential installation procedure from the residence or commercial facility to the soil absorption field;
      4) Requirements for installation, including:
         a) Plumbing and electrical power requirements;
         b) Ventilation and air intake protection;
         c) Miscellaneous fittings and appurtenances;
         d) Maximum slope in which experimental or alternative technology can be installed;
         e) Bedding, water tightness, and hydrostatic displacement protection; and
         f) Final grading to direct surface water away from the experimental or alternative technology.
   d. Requirements for experimental technology start-up, including:
      1) The estimated length of time required for start-up and for achieving stable operation; and

2) The initial operating and environmental conditions required for start-up, and the range for any conditions that may require modification during the start-up period, including:
   a) Flow rates;
   b) Chemical additives; and
   c) Component calibration and settings.

3. A manufacturer of an experimental or alternative technology must provide comprehensive and detailed O&M manuals to authorized service representatives. The O&M manual must contain, as applicable, the following:
   a. Manufacturer, model number or product identification, power requirements, and specifications for all equipment, devices, products, and materials used in the experimental or alternative technology.
   b. Requirements for O&M, including:
      1) Schedule of required inspection and maintenance for the experimental or alternative technology and components;
      2) Requirements for the periodic removal of residuals from the experimental or alternative technology;
      3) A detailed procedure for visual evaluation of the function of the experimental or alternative technology and components;
      4) A detailed procedure for the evaluation of the function of the experimental or alternative technology and components using instruments and measuring devices; and
      5) A detailed procedure for the maintenance of the experimental or alternative technology and components.
   c. Requirements for trouble shooting and repair, including:
      1) Guidelines for visually evaluating the experimental or alternative technology and narrowing the scope of problems based on effluent characteristics, experimental or alternative technology operation, and history.
      2) A sequential method, including the use of instruments and measuring devices, for isolating specific component failure; and
      3) Procedures for repairing or replacing all experimental or alternative technology components.
   d. Names, addresses and telephone numbers of licensed septic cleaners.

## III. Additional Requirements for Individually Designed Secondary Treatment Devices & Experimental and Alternative Technology Soil Absorption Fields

A. Manuals for owners, designers and installers, and service representatives for individually designed secondary treatment devices, and experimental and alternative technology soil absorption fields, must contain:

1. Information addressing all of the applicable requirements of *Section III. A., B. and C*. of this chapter; and
2. Requirements for the control of erosion.

B. Manufacturers of experimental and alternative technology soil absorption fields must provide complete instructions for the sizing, design and installation of the experimental and alternative technology soil absorption field.

C. Designers of experimental and alternative technology soil absorption fields must provide, in the design, provisions for the metering of dose volumes and frequencies to the experimental and alternative technology soil absorption field.

D. Manufacturers, manufacturer agents, engineers, or designers of individually designed secondary treatment devices must provide:

1. Two copies of engineered drawings with each plan submittal for a property or project to the department or local health department, whichever has authority for plan review; and
2. Field supervision for all phases of construction.

## IV. Performance Monitoring

A. The department may require:

1. Each manufacturer of a manufactured secondary treatment device to sample and analyze effluent quality of up to ten (10) units of each model; and
2. Each designer of an individually designed secondary treatment device to sample and analyze effluent quality.

B. For secondary treatment devices that the department requires sampling and analysis of effluent quality, the manufacturer, designer, or its contractor, must:

1. Perform performance monitoring of the secondary treatment device for three years from the date of initial operation, as follows:
   a. Monthly sampling and analysis for the first year of operation; and
   b. Quarterly sampling and analysis for the second and third year of operation.
2. Provide the department with the name, address and telephone number of:
   a. The entity contracted to perform sampling; and
   b. The laboratory contracted to perform chemical analysis.
3. Provide measurements of sewage flow.

C. Performance monitoring must be performed for biochemical oxygen demand—five day average ($BOD_5$), total suspended solids (TSS) and, when applicable, total nitrogen, for:

1. The septic tank effluent (baseline effluent quality); and
2. The secondary treatment device.

D. Requirements for sampling, laboratory analysis, and reporting.

1. The point of sampling must be:
   a. A location that is representative of final discharge from:
      1) The septic tank; and
      2) The secondary treatment device.
   b. Detailed on the plan submittal required in *Chapter 2, Section V*.
2. Requirements for grab samples.

a. Each secondary treatment device manufacturer, or its contractor, must notify the department of the days and times that samples will be taken at least two (2) working days prior to sampling.
b. Samples must be collected:
1) On weekdays between 7:30 a.m. and 9:30 a.m. on days a residence is occupied; or
2) When a commercial facility is in operation.

3. Samples must be collected and analyzed according to the methods prescribed in the current edition of the *Standard Methods for the Examination of Water and Wastewater* (American Public Health Association) or equivalent.
4. The laboratory performing the analysis must report the specific laboratory procedures used in the analysis, and, if the procedures used are not from the *Standard Methods for the Examination of Water and Wastewater*, certify that the sampling and analysis methods used are equivalent to those contained in the *Standard Methods for the Examination of Water and Wastewater*.
5. The laboratory results of all sampling and analysis must be submitted to the department and the local health department within 1 month of the date of sampling.

E. If the sample results exceed 30 mg/L for either $BOD_5$ or TSS, the secondary treatment device manufacturer or designer must:

1. Provide all alterations or maintenance necessary to bring the effluent quality of the secondary treatment device below these effluent quality requirements within a timeframe set by the department. If alterations to any experimental technology onsite system component are necessary, the manufacturer or designer must obtain necessary approvals from the department and permits from the local health department; and
2. Provide documentation to the department, and local health department, of the alterations made or maintenance performed.

F. The department may:

1. Extend the performance monitoring period, or the scope of monitoring, for the secondary treatment device until such time that it is shown to perform consistently within these effluent quality requirements; or
2. Shorten the performance monitoring period for the secondary treatment device if it is shown to perform consistently within these effluent quality requirements.

## V. Requirements for Individually Designed Secondary Treatment Devices

A. General Requirements

1. Secondary treatment devices must comply with the requirements of *Section I, General Requirements* of this chapter.
2. The influent concentrations for $BOD_5$ and TSS to aerobic treatment units, recirculating sand filters, non-recirculating sand filters, and constructed wetlands must be two-hundred and fifty (250) milligrams per liter (mg/L) or less.

3. Owners of devices for secondary treatment approved under this section must meet the O&M *or* performance monitoring requirements of *Section II. Operation and Maintenance (O&M)* of this chapter.

## B. General Individually Designed Secondary Treatment Device Components

Requirements for media, and for components common to two or more secondary treatment devices, are included in this section. Requirements unique to each secondary treatment device are included in the sections following this section.

1. General Components.
   a. Filter media and aggregate must be washed by the supplier to remove fines, dust and clay.
   b. Requirements for pipe and design.
      1) All pipe must comply with the pipe standards contained in *Chapter 5, Figure 5-2, List of Acceptable Pipe*.
      2) Requirements for underdrain collection pipe for sand filters.
         a) Underdrain collection pipe must be drainpipe or gravity distribution lateral pipe.
         b) There must be at least fifteen (15) total lineal feet of underdrain collection pipe for each two-hundred and twenty-five (225) square feet ($ft^2$) of filter area, spaced no more than ten (10) feet apart.
         c) Barrier material must not be wrapped around the pipe.
      3) Requirements for pressure distribution laterals and manifolds for sand filters.
         a) Manifolds may be end feed or center feed.
         b) Pressure distribution laterals and manifolds must be no less than three-quarter (3/4) and no more than two (2) inches in diameter.
         c) Pressure distribution laterals must be spaced a maximum of two (2) feet apart on-center in a parallel grid.
         d) The sides and ends of the pressure distribution laterals must be located six (6) to twelve (12) inches from an edge of the recirculating sand filter.
         e) One-eighth (1/8) inch holes must be spaced a maximum of two (2) feet apart in the pressure distribution laterals.
   c. Requirements for pressure distribution networks in sand filters.
      1) The media must be dosed with a low pressure distribution network.
      2) The design head ($H_D$) for the pressure distribution network must be at least five (5) feet. [The discharge rate for a one-eighth (1/8) inch hole at a design head ($H_D$) of five (5) feet is forty-one hundredths (0.41) gallons per minute (gpm)].
      3) Pressure distribution laterals and manifolds must not result in a pressure loss of more than ten (10) percent from the manifold to the distal end of the lateral.
   d. Requirements for flexible liners.
      1) Material for flexible liners must be polyvinyl chloride (PVC), ultraviolet (UV) light resistant polyethylene, or ethylene propylene diene monomer (EPDM) rubber.
      2) Flexible liners must be:

a) Thirty (30) mil in thickness or greater for polyvinyl chloride (PVC) and ultraviolet (UV) light resistant polyethylene;
b) Forty-five (45) mil in thickness or greater for EPDM rubber.

3) The physical properties of patches, repairs and seams in a flexible liner must be equal to or exceed the physical properties of the flexible liner.

e. Requirements for the installation of flexible liners.

1) The flexible liner must be:
a) Transported, handled and stored to prevent damage;
b) Protected from weathering and sunlight; and
c) Dry for seaming, patching and connecting "boots".

2) The flexible liner must be installed in the following climatic conditions:
a) The temperature must be between 42° F to 90° F; and
b) Gusty winds must be avoided to prevent interference with flexible liner placement; alignment of seams; and contamination of seams, patches, and boot connections.

3) The subgrade must be maintained in a smooth, uniform and compacted condition during installation of the lining.

4) The final cut size of the flexible liner must generously fit the subgrade and sidewall geometry without straining of the flexible liner material. The flexible liner must:
a) Be installed to minimize elongation and strain; and
b) Have no surfaces exposed to sunlight or weathering.

5) Flexible liner placement and watertight installation.
a) Flexible liner panels must be positioned to minimize handling.
i) The flexible liner must not be stressed during installation.
ii) The flexible liner must not bridge any portion of the subgrade or sidewalls.
iii) The flexible liner must be secured to prevent movement during installation of underdrains, influent and effluent manifolds, pressure distribution laterals, and media.
b) Factory seams in the flexible liner must be inspected after installation according to manufacturer’s recommended procedures.
c) Where pipe penetrations of the flexible liner are necessary, connections to the flexible liner and pipes must be watertight and installed according to manufacturer’s recommended procedures.
d) Field seaming (if unavoidable) and field repairs (if necessary) must be:
i) Watertight;
ii) Performed only when contact surfaces of the materials are free of dirt, dust, moisture, and all other foreign materials; and
iii) Made according to manufacturer’s recommended procedures.
e) The flexible liner must be visually inspected after installation for punctures and tears, and tested by one of the following two methods to insure a watertight membrane at seams, patches, penetrations and connections:

i) Inlets and outlets must be plugged and the flexible liner flooded by at least one (1) foot of water above the highest boot connection. After a twenty-four (24) hour period there must be no loss of water except for evaporation; or

ii) An air lance test must be performed at all seams, patches, penetrations and connections. This test must be performed using a minimum fifty (50) pounds per square inch (psi) air supply directed through a three-sixteenths (3/16) inch nozzle held not more than two inches from the edge being tested. Riffles must not occur at any seam.

f) Requirements for inspection and repair of the flexible liner.

i) The flexible liner must be visually inspected for punctures and tears after each stage of the construction of the recirculating sand filter, including, but not limited to, the installation of underdrains, influent and effluent manifolds, pressure distribution laterals, and media.

ii) Punctures and tears, resulting from the construction of the recirculating sand filter, must be repaired according to manufacturer's recommended procedures.

## C. Individually Designed Recirculating Sand Filters

1. General Components.
   a. Requirements for filter media and aggregate.
      1) Filter media and aggregate must meet the gradation requirements contained in *Figure 8-2, Aggregate for Field Constructed Recirculating Sand Filters*.
      2) Filter media and aggregate must be washed by the supplier to remove fines, dust and clay.
2. Design and Installation.
   a. Requirements for design and recirculating sand filter components.
      1) Requirements for design.
         a) The maximum hydraulic load rate must be five (5) gallons per day per square foot ($gpd/ft^2$).
         b) The maximum area must not exceed four-hundred (400) square feet ($ft^2$).
         c) Multiple recirculating sand filters must be equal in size and provided with alternate doses.
         d) The total area of a recirculating sand filter (RSF) or multiple recirculating sand filters must be the design daily flow (DDF) divided by the hydraulic load rate:

$$\text{total area of RSF(s)} = \frac{\text{DDF (gpd)}}{\text{hydraulic load rate } (gpd/ft^2)}.$$

      2) Requirements for filter media.
         a) Filter media must be approved by the local health department or department, whichever has authority.

b) Filter media must be composed of sand with an effective size of one and one-half (1.5) millimeter to two and one-half (2.5) millimeter and a coefficient of uniformity ($C_u$) of two (2) or less, as required in *Figure 8-2, Aggregate for Field Constructed Recirculating Sand Filters*.

**Figure 8-2**
**Aggregate for Field Constructed Recirculating Sand Filters**

| Sieve Sizes | Percent (%) Passing Sieve (by Weight) | | |
|---|---|---|---|
| | INDOT* Specification for Aggregate | | Filter Media[1] |
| | 8 | 11 | |
| 4 in (100 mm) | | | |
| 3 ½ in. (90 mm) | | | |
| 2 ½ in. (63 mm) | | | |
| 1 ½ in. (37.5 mm) | | | |
| 1 in. (25 mm) | 100 | | |
| 3/4 in. (19 mm) | 75 – 95 | | |
| 1/2 in. (12.5 mm) | 40 – 70 | 100 | |
| 3/8 in. (9.50 mm) | 20 – 50 | 75 – 95 | 100 |
| No.4 (4.75 mm) | 0 – 15 | 10 – 30 | 60 – 100 |
| No. 8 (2.36 mm) | 0 – 10 | 0 – 10 | 7 – 75 |
| No. 16 (1.18 mm) | | | 0 – 5 |
| No. 30 (600 µm) | | | 0 – 3 |
| No. 50 (300 µm) | | | 0 – 2 |
| No. 100 (150 µm) | | | 0 – 1 |
| No. 200 (75 µm) | | | 0 – 1 |
| Decant Concentration[2] | 0 – 1.5 | 0 – 1.5 | 0 |
| Other | 0 – 3.0 | 0 – 2.5 | 0 |

* INDOT: Indiana Department of Transportation.

[1] Filter media must be composed of sand with an effective size of 1.5 mm to 2.5 mm and a coefficient of uniformity ($C_u$) of 2 or less.

[2] When the material is stone or slag, the decant may be 0 – 2.5.

c) Filter media must be:
   i) Washed by the supplier to remove fines, dust and clay.
   ii) Analyzed by a laboratory approved by the Indiana Department of Transportation (INDOT).
      (1) Data on the gradation of the filter media must be plotted on semi-log paper as a gradation curve.
      (2) The laboratory analysis (including the gradation curve) must be submitted by the owner or agent prior to final inspection in a report to the local health department or department, whichever has authority, for approval.

d) The owner or agent must analyze the filter media as follows:

i) If the filter media is a custom blend, sample and analyze the filter media; or

e) If the filter media is from an ongoing stock, the supplier must certify, through analysis, the stockpiled filter media.

b. Requirements for recirculating tanks.

A recirculating tank receives effluent from both the septic tank and the underdrain of the recirculating sand filter. Pumps are used to deliver effluent to the pressure distribution laterals in the recirculating sand filter.

1) Specifications for the recirculating tank.

a) The recirculating tank must:

i) Have a capacity of at least one-third (1/3) design daily flow (DDF) between the high and low level float overrides; and

ii) Have a capacity of at least one-third (1/3) design daily flow (DDF) above the high level float override.

b) The recirculating tank must be provided with an access opening to maintain the tank, remove solids, and maintain and replace pump(s) and floats without entering the tank.

2) All devices that recirculate effluent must be designed to:

a) Divert a minimum of 80% of the recirculate to the recirculating tank; and

b) Ensure that the recirculating tank maintains sufficient effluent levels to dose the device during periods when the residence or commercial facility is not generating sewage.

c) Specification for the timer for the recirculating tank recirculating pump.

i) The recirculating tank pump timer must be set to provide a total daily volume of effluent (TDVE) with a recirculating ratio (RR) of at least five (5) times the design daily flow (DDF) of the onsite system:

$$TDVE = RR \times DDF \text{ (gpd)},$$

where $RR \geq 5$.

ii) The recirculating tank pump timer must be set to dose the recirculating sand filter at a dose frequency of forty-eight (48) to ninety-six (96) times per day [once every thirty (30) to fifteen (15) minutes, respectively] while maintaining the recirculating ratio:

$$\text{RSF dose (gal)} = \frac{RR \times DDF \text{ (gpd)}}{48 - 96 \text{ doses/day}}.$$

iii) The pump run time (PRT) must be the RSF dose divided by the total discharge rate (TDR) from all holes in the pressure distribution laterals at the design head ($H_D$) of the pressure distribution network:

$$PRT = \frac{\text{RSF dose (gal)}}{\text{TDR (gpm) @ } H_D},$$

where TDR = no. of 1/8" holes x discharge (gpm) per hole (0.41 gpm @ $H_D$ of 5 ft).

iv) If the high level float in a recirculating tank is activated, the recirculating frequency must be increased up to twice the normal frequency until the high effluent level condition is eliminated.

d) The recirculating tank dose pump must meet the minimum requirements for total dynamic head (TDH) and total discharge rate (TDR) for the pressure distribution network.

e) There must be no bypass capability designed into the recirculating sand filter which will allow effluent to be discharged to a soil absorption field without undergoing all the treatment processes necessary to achieve the required effluent quality.

c. One of the following methods must be used to prepare the site for the flexible liner subgrade.

1) Preparation of the subgrade using sand.

a) The soil must be:

i) Excavated to a minimum of four (4) inches below the final grade of the placement of the bottom of the flexible liner; and

ii) Leveled throughout its length and width.

b) The sidewalls must be formed with pressure treated plywood or concrete.

c) The following must be placed over the bottom of the excavation:

i) A layer of fine to coarse sand at least four (4) inches thick, free from rock, fractured stone, debris, and roots; and

ii) Leveled throughout its length and width and compacted.

2) Preparation of the subgrade using manufacturer's protective blanket.

a) The soil must be excavated to the final grade of the placement of the bottom of the flexible liner.

b) The sidewalls must be formed with pressure treated plywood or concrete.

c) The soil must be leveled throughout its length and width and compacted.

d) A protective blanket, recommended by the manufacturer, must be placed over the bottom of the excavation.

d. The following components must be installed after installation of the flexible liner.

1) Effluent underdrain collection pipe must be installed on the flexible liner.

a) The underdrain collection pipe(s) must be vented to atmosphere at the opposite end of the underdrain collection pipe outlet.

b) The vent must be fitted with a turned down elbow or vent cap and be screened to prevent insect entry.

2) Eight (8) inches of INDOT Spec. 8 underdrain media must be placed on the flexible liner and effluent collection pipe.
3) A minimum of twenty-four (24) inches of filter media must be placed over the underdrain media.
4) A one and one-half (1 1/2) inch layer of INDOT Spec. 11 or INDOT Spec. 8 overlain media must be placed over the filter media.
5) The pressure distribution network must be installed on the one and one-half (1 1/2) inch layer of INDOT Spec. 11 or INDOT Spec. 8 overlain media.
6) Each pressure distribution lateral hole must face up and be shielded.
7) The pressure distribution network must drain between doses.
8) Each pressure distribution lateral pipe must terminate with a threaded plug or cap. The plug or cap must be accessible for removal to allow flushing of the pressure distribution network.
9) An additional one and one-half (1 1/2) inch layer of INDOT Spec. 11 or INDOT Spec. 8 overlain media must be placed over the pressure distribution laterals, hole shields, and the existing layer of overlain media.

e. The following requirements must be met after installation.
1) The recirculating sand filter must be protected from freezing.
2) The final grade must divert surface water away from the recirculating sand filter.
3) One of the following methods must be used to restrict access onto the recirculating sand filter.
a) Install a fence with a minimum height of four (4) feet.
b) Install a wood deck over the recirculating sand filter.
i) Support posts must not penetrate the liner; and
ii) The recirculating sand filter must be accessible to perform inspection and maintenance.
c) Install perforated decorative pavers over the recirculating sand filter.
d) Install a rigid barrier material, such as vinyl lattice or vinyl coated snow fencing, over the pressure distribution laterals and beneath the overlain media.

## D. Individually Designed Non-Recirculating Sand Filters

1. Requirements for design and non-recirculating sand filter components.
a. Requirements for design.
1) The maximum hydraulic load rate must be three (3) gallons per day per square foot ($gpd/ft^2$).
2) The maximum area of a non-recirculating sand filter must not exceed fifteen-hundred (1500) square feet ($ft^2$).
3) Multiple non-recirculating sand filters must be equal in size and be provided with alternate doses.
4) The total area of a non-recirculating sand filter (NRSF) or multiple non-recirculating sand filters must be the design daily flow (DDF) divided by the hydraulic load rate:

$$\text{Total area of NRSF} = \frac{\text{DDF (gpd)}}{\text{hydraulic load rate (gpd/ft}^2\text{)}}.$$

b. Requirements for filter media.

1) Filter media must be approved by the local health department or department, whichever has authority, and be composed of sand from four-tenths (0.4) millimeter to one (1.0) millimeter in diameter with a coefficient of uniformity ($C_u$) of four (4) or less.

2) Filter media must be:

a) Washed by the supplier to remove fines, dust and clay.

b) Analyzed by a laboratory approved by the Indiana Department of Transportation (INDOT).

i) Data on the gradation of the filter media must be plotted on semi-log paper as a gradation curve.

ii) The laboratory analysis (including the gradation curve) must be submitted to the local health department or department, whichever has authority, for approval.

c) The owner or agent must analyze the filter media as follows:

i) If the filter media is a custom blend, sample and analyze the filter media; or

ii) If the filter media is from an ongoing stock, the supplier must certify, through analysis, the stockpiled filter media.

c. Requirements for dose volume.

1) If the effluent force main and manifold do not drain to the dose tank, the encapsulated float level controls for the pressure distribution network must be set to deliver one-quarter (1/4) of the design daily flow (Dose = 1/4 DDF).

2) If the effluent force main and manifold drain to the dose tank, the encapsulated float level controls for the pressure distribution network must be set to deliver one-quarter (1/4) of the design daily flow (DDF) plus the volumes of the effluent force main (Dose = 1/4 DDF + $Vol_{FM}$).

3) The dose pump must meet the minimum requirements for total dynamic head (TDH) and total discharge rate (TDR) for the pressure distribution network.

## E. Subsurface Constructed Wetlands

1. Requirements for design and subsurface constructed wetland components.

a. Requirements for design.

1) The total area of the subsurface constructed wetland (SCW) bottom must be at least one (1) square foot ($ft^2$) per gallon per day (gpd) of design daily flow (DDF) of the onsite system.

$$\text{total area of SCW} \geq 1\ ft^2/gpd \times \text{DDF (gpd)}.$$

2) Multiple cells are required if the total area of a subsurface constructed wetland cell bottom exceeds seven-hundred and fifty (750) square feet ($ft^2$).

3) The length-to-width ratio of a subsurface constructed wetland cell must be two-to-one (2:1).
4) Multiple subsurface constructed wetland cells must be equal in size.
5) The subsurface constructed wetland must be located to receive full sunlight.

b. If a dose tank is located between the septic tank and the subsurface constructed wetland, the dose must be timed to deliver ten (10) equal doses per day. Dose tanks must meet the minimum requirements of the *Chapter 5, Section V, Dose Tanks* of this document.
1) If the effluent force main and manifold do not drain to the dose tank, the timer must be set to deliver one-tenth (1/10) of the design daily flow (Dose = 1/10 DDF).
2) If the effluent force main and manifold drain to the dose tank, the timer must be set to deliver one-tenth (1/10) of the design daily flow (DDF) plus the volume within the effluent force main (Dose = 1/10 DDF + $Vol_{FM}$).
3) The dose pump must meet the minimum requirements for total dynamic head (TDH) and total discharge rate (TDR) for the OSS (see *Chapter 5, Section VIII, Pumps* of this document).

2. Requirements for inlet structures and outlet sumps.
a. For a subsurface constructed wetland with multiple cells, an inlet structure must be installed.
1) An inlet structure must be a watertight device.
2) The inlet structure must distribute effluent evenly between subsurface constructed wetland cells.
3) The effluent sewer or force main within the inlet structure must be fitted with a turned-down elbow.

b. A level-adjusting outlet sump must be installed at the outlet end of the subsurface constructed wetland.
1) The outlet sump must be a watertight device.
2) The outlet effluent sewer into the outlet sump must have an adjustable vertical extension set to maintain the level of effluent in the subsurface constructed wetland at two (2) to three (3) inches below the finished grade of the aggregate within the subsurface constructed wetland.
3) The outlet effluent sewer into the outlet sump, or the effluent sewer from the outlet sump, must have a threaded cap with a one-half (1/2) to one and one-half (1 1/2) inch drilled hole.
4) The effluent sewer from the sump must outlet to a distribution box or a dose tank.

c. Inlet structures and outlet sumps must have securely fastened insulated lids.

3. Site preparation for the flexible liner subgrade.
a. One of the following methods must be used to prepare the site for the flexible liner subgrade.
1) Preparation of the subgrade using sand.
a) The soil must be:
i) Excavated to a minimum of four (4) inches below the final grade of the placement of the bottom of the flexible liner; and

ii) Leveled throughout its length and width.

b) The following must be placed over the bottom of the excavation:

i) A layer of fine to coarse sand at least four (4) inches thick, free from rock, fractured stone, debris, and roots; and

ii) Leveled throughout its length and width and compacted.

2) Preparation of the subgrade using manufacturer's protective blanket.

a) The soil must be excavated to the final grade of the placement of the bottom of the flexible liner.

b) The soil must be leveled throughout its length and width and compacted.

c) A protective blanket, recommended by the manufacturer, must be placed over the bottom of the excavation.

b. The perimeter sidewall berm must:

1) Be formed from debris-free soil material; and

2) Have the following dimensions:

a) A height of three (3) feet or greater above the finished elevation of the subgrade;

b) A bottom width of seven (7) feet or greater; and

c) Side slopes of one-to-one (1:1).

c. The sidewalls between multiple subsurface constructed wetland cells must be one of the following:

1) A sidewall berm meeting the requirements of *Section V. E. 3. b.* of this chapter;

2) A sidewall fence constructed from pressure treated lumber; or

3) A four (4) inch thick sidewall constructed from reinforced concrete.

4. Requirements for flexible liners.

a. General requirements for flexible liners.

1) Material for flexible liners must be polyvinyl chloride (PVC), ultraviolet (UV) light resistant polyethylene, or ethylene propylene diene monomer (EPDM) rubber.

2) Flexible liners must be:

a) Thirty (30) mil in thickness or greater for polyvinyl chloride (PVC) and ultraviolet (UV) light resistant polyethylene;

b) Forty-five (45) mil in thickness or greater for EPDM rubber.

3) The physical properties of patches, repairs and seams in a flexible liner must be equal to or exceed the physical properties of the flexible liner.

b. Requirements for the installation of flexible liners.

1) The flexible liner must be:

a) Transported, handled and stored to prevent damage;

b) Protected from weathering and sunlight; and

c) Dry for seaming, patching and connecting "boots".

2) The flexible liner must be installed in the following climatic conditions:

a) The temperature must be between 42° F to 90° F; and

b) Gusty winds must be avoided to prevent interference with flexible liner placement; alignment of seams; and contamination of seams, patches, and boot connections.

3) The subgrade must be maintained in a smooth, uniform and compacted condition during installation of the lining.

4) The final cut size of the flexible liner must generously fit the subgrade and sidewall geometry without straining of the flexible liner material. The flexible liner must:
   a) Be installed along the sidewalls to a height of two (2) – six (6) inches or greater above the finished elevation of the subgrade.
   b) Be installed to minimize elongation and strain; and
   c) Have no surfaces exposed to sunlight or weathering.

5) Flexible liner placement and watertight installation.
   a) Flexible liner panels must be positioned to minimize handling.
      i) The flexible liner must not be stressed during installation.
      ii) The flexible liner must not bridge any portion of the subgrade or sidewalls.
      iii) The flexible liner must be secured to prevent movement during installation of influent and effluent manifolds, and media.
   b) Factory seams in the flexible liner must be inspected after installation according to manufacturer's recommended procedures.
   c) Where pipe penetrations of the flexible liner are necessary, connections to the flexible liner and pipes must be watertight and installed according to manufacturer's recommended procedures.
   d) Field seaming (if unavoidable) and field repairs (if necessary) must be:
      i) Watertight;
      ii) Performed only when contact surfaces of the materials are free of dirt, dust, moisture, and all other foreign materials; and
      iii) Made according to manufacturer's recommended procedures.
   e) The flexible liner must be visually inspected after installation for punctures and tears, and tested by one of the following two methods to insure a watertight membrane at seams, patches, penetrations and connections:
      i) Inlets and outlets must be plugged and the flexible liner flooded by at least one (1) foot of water above the highest boot connection. After a twenty-four (24) hour period there must be no loss of water except for evaporation; or
      ii) An air lance test must be performed at all seams, patches, penetrations and connections. This test must be performed using a minimum fifty (50) pounds per square inch (psi) air supply directed through a three-sixteenths (3/16) inch nozzle held not more than two inches from the edge being tested. Riffles must not occur at any seam.
   f) Requirements for inspection and repair of the flexible liner.

i) The flexible liner must be visually inspected for punctures and tears after each stage of the construction of the subsurface constructed wetland, including, but not limited to, the installation of influent and effluent manifolds, and media.

ii) Punctures and tears, resulting from the construction of the subsurface constructed wetland, must be repaired according to manufacturer's recommended procedures.

5. Requirements for components installed after the flexible liner.

a. The following must be placed on the inlet end of the subsurface constructed wetland:

1) A two (2) to four (4) inch layer of INDOT Spec. 1 aggregate must be placed on the liner and extend four (4) feet or more from the inlet end of the subsurface constructed wetland. Consideration must be given to the permeability and hydraulic conductivity of the central aggregate in determining the appropriate length of this layer of aggregate into the wetland.

2) The influent manifold must be installed on this layer of aggregate six (6) to eighteen (18) inches from the inlet end of the subsurface constructed wetland.

3) An additional twenty (20) to twenty-two (22) inch layer of INDOT Spec. 1 aggregate must be placed on the two (2) to four (4) inch layer of INDOT Spec. 1 aggregate, resulting in a total of twenty-four (24) inches of INDOT Spec. 1 aggregate over the liner.

4) The side slope of the INDOT Spec. 1 aggregate at the central aggregate interface must be one-to-one (1:1).

b. The following must be placed on the outlet end of the subsurface constructed wetland.

1) A two (2) to four (4) inch layer of INDOT Spec. 1 aggregate must be placed on the liner and extend three (3) feet from the outlet end of the subsurface constructed wetland.

2) The effluent manifold must be installed on this layer of INDOT Spec. 1 aggregate six (6) to twelve (12) inches from the outlet end of the subsurface constructed wetland.

3) An additional twenty (20) to twenty-two (22) inch layer of INDOT Spec. 1 aggregate must be placed on the two (2) to four (4) inch layer of INDOT Spec. 1 aggregate, resulting in a total of twenty-four (24) inches of INDOT Spec. 1 aggregate.

4) The side slope of the INDOT Spec. 1 aggregate at the central aggregate interface must be one-to-one (1:1).

c. The influent and effluent manifolds must be fitted with a four (4) inch cleanout at both ends that extend above the finished grade of the subsurface constructed wetland aggregate.

1) The central aggregate must be eighteen (18) inches of INDOT Spec. 8 aggregate with a six (6) inch top layer of INDOT Spec 11 pea gravel.

d. Barrier material must not be installed between any media within the constructed wetland.

6. Requirements for plants and planting.

a. The subsurface constructed wetland must be insulated as follows:
    1) Place a two (2) – six (6) inch layer of mulch, free of undesirable weed species and seeds, over the aggregate; and
    2) Cover the mulch with a woven biodegradable netting or jute.
b. The subsurface constructed wetland must be planted at least ten (10) weeks before the first hard frost. If planting cannot take place at least ten (10) weeks before the first hard frost, then planting must be postponed until spring.
c. Air temperature at the time of planting must be forty (40) degrees Fahrenheit or greater.
d. A variety of at least two (2) species of wetland perennials with deep, dense fibrous root systems and winter tolerance must be planted in the subsurface constructed wetland. [Examples of plants indigenous to Indiana include cattails (typha), bulrushes (scirpus), rushes (jancus), and sedges (carex)].
e. Plants of the same species must be grouped within the subsurface constructed wetland.
f. Plant rows must be perpendicular to the direction of flow.
g. Plant rows must be separated by eighteen (18) inches, and plants must be staggered by nine (9) inches.
h. Shallower root plants must be located near the inlet to the subsurface constructed wetland, with the deeper root plants located near the outlet of the subsurface constructed wetland.
i. Plants must be inserted three (3) to four (4) inches into the pea gravel with the shoots slightly exposed and the roots placed in water. Plant roots must be kept wet at all times by:
    1) The immediate application of effluent; or
    2) Filling the subsurface constructed wetland with water to within two (2) to three (3) inches of final grade.
        a) The water level must be maintained.
        b) Water-soluble plant food must be applied, at the manufacturer's lowest recommended rate for lawns, to the subsurface constructed wetland once every three weeks until effluent is available.
j. If plants do not take hold and show visible signs of growth within ten (10) weeks, replanting must be done in-between the original plants.

7. Requirements after installation of the subsurface constructed wetland.
    a. The final grade around the outer berm must divert surface water away from the subsurface constructed wetland.
    b. A fence with a minimum height of four (4) feet must restrict access onto the subsurface constructed wetland.
    c. The control and removal of undesirable plants.
    d. The control of burrowing animals.

# Appendix A: Glossary

A number of definitions are grouped under the following words: 'drain', 'grade', 'onsite system', 'pipe', 'slope', 'soil' and 'soil absorption field'. Users of this glossary should become familiar with the location and words defined under these groupings.

**ABS:** acrylonitrile-butadiene-styrene.

**ASTM:** American Society for Testing and Materials.

**Aerobic treatment unit (ATU):** a unit for the treatment of sewage through the addition of supplemental air or dissolved oxygen by means of mechanical or diffused aeration.

**Barrier material:** woven or spun-bonded sheet geotextile fabric used to impede or prevent the movement of sand, silt or clay into aggregate or drainpipe.

**Bedroom:** any room in a residence that is used for the purpose of sleeping and contains an area of forty-five (45) square feet or more and at least one (1) operable window or exterior door approved for emergency egress or rescue.

**Benchmark:** fixed point whose elevation is known or assumed.

**Biochemical oxygen demand, five-day ($BOD_5$):** the concentration of oxygen (expressed as mg/L) utilized in microorganisms in the oxidation of organic matter during a five day period at temperature of $20^{O}$ C., analyzed in accordance with *Standard Methods for the Examination of Water and Wastewater.*

**Breakaway flange:** a plumbing connection within the dosing tank or lift station that allows easy connection or disconnection of the pump to the force by a lift mechanism without entering the dosing tank or lift station.

**Cam-lock union:** a quick disconnect plumbing device, utilizing cams for locking the plumbing fittings of the pump and force main together.

**Commercial facility:** any building or place not used exclusively as a residence or residential outbuilding. A Commercial facility includes, but is not limited to: an office building; a manufacturing facility; a single structure used or intended to be used for permanent or seasonal human habitation for sleeping three (3) or more families (apartment, multiplex, townhouse, or condominium); a motel; a restaurant; a regulated facility; and any grouping of residences served by a cluster onsite system.

**Construction:** includes, but is not limited to, earth-moving operations, excavation of an existing grade for a foundation or footings, delivery of construction materials to the property, or delivery of manufactured housing.

**Contour:** a line connecting points of equal elevation on the surface of a landform.

**Corrosion resistant:** materials, such as stainless steel, fiberglass, SCH 40 or SCH 80 PVC, or reinforced plastic, that are resistant to gradual wearing away and destruction by a chemical oxidizing process.

**Department:** Indiana state department of health.

**Design daily flow (DDF):** assigned peak daily flow of sewage, in gallons per day, from a residence or commercial facility as calculated from Chapter 5, Section 1.

**Distribution box:** device designed to equally distribute effluent by gravity from an inlet pipe to outlet pipes.

**Disturbance or alteration of a soil absorption field site:** includes, but is not limited to, the following:

1. The addition of fill.
2. The cutting, scraping, or removal of soil.
3. Compaction of soil at the site resulting in densic material.
4. Erosion or sedimentation.
5. The removal of tree root balls.

**Diverter device:** a valve or device that directs effluent from one gravity soil absorption field to another gravity soil absorption field.

**Dose tank:** watertight structure into which septic tank effluent discharges for collection and pumping to a soil absorption field.

**Downslope:** downward inclination between two points on a landform such that the beginning point is at a higher elevation than the ending point.

**Drain, foundation:** system of below ground pipes or tiles installed to drain subsurface water from outside of the foundation of a structure or from under an impermeable floor.

**Drain, interceptor:** part of an onsite system subsurface drainage system that is used to control the seasonal high water table ($SH_2O$) of the soil. An interceptor drain is located on the soil on the upslope side of an onsite system soil absorption field to intercept and remove excess water from the soil. It is connected to a main drain.

**Drain, main:** part of an onsite system subsurface drainage system that connects the perimeter drain, interceptor drain(s), or segment drain(s), to an existing subsurface drain or to the point of surface discharge.

**Drain, perimeter:** part of an onsite system subsurface drainage system that is used to control the seasonal high water table ($SH_2O$) of the soil. A perimeter drain is located completely around an onsite system soil absorption filed to intercept and remove excess water from the soil. It is connected to a main drain.

**Drain, residential or commercial:** pipe in a residence, or commercial facility, ending two (2) feet outside a structure, that receives the discharge from waste pipes and connects to a gravity sewer.

**Drain segment:** part of an onsite system subsurface drainage system that is used to control the seasonal high water table of the soil. It is installed between trenches and sand mounds in conjunction with a perimeter drain or an interceptor drain to intercept and remove excess water from the soil.

**Drain, subsurface:** underground drainage system not used to lower the seasonal high water table ($SH_20$) of an onsite system. They include, but are not limited to, gutter outlet drains, foundation drains, and agricultural drains.

**Drain, subsurface onsite system:** subsurface drainage system that is used to control the seasonal high water table of the soil in an onsite system soil absorption field. Onsite system subsurface drains include perimeter drains, interceptor drains, segment drains, and main drains up to the point of entry into an existing subsurface drain or to the point of surface discharge.

**Drain, surface diversion:** natural or manmade barrier that changes the course of overland flow of water around an onsite system soil absorption field.

**Drainage outlet:** discharge point from an onsite system main drain.

**Drainageway:** channel portion of the landscape in which surface water or rainwater runoff gathers intermittently to flow to a lower elevation.

**Effluent:** sewage that has received treatment from a septic tank, or other means approved by the department, before treatment in the soil.

**Effluent distribution device:** an apparatus for dividing effluent flow between soil absorption field trenches or elevated beds. Effluent distribution devices include, but are not limited to, a distribution box, header and discharge pipes, and manifolds.

**Encapsulated float switch:** an electrical switch (mercury or mechanical) enclosed within polyurethane resin or plastic on the end of a tether that provides control over the pump operation or activates the audiovisual alarm.

**Fill:** "Fill" is characterized by one (1) or more of the following:

1. No soil horizons;
2. Depositional stratification created by the movement of soil by man;
3. A soil horizon that has been covered;
4. Soil structure that has been modified or altered;
5. Materials not indigenous to a soil horizon, such as cinders, refuse, and construction materials.

**Flexible liner:** a layer of polyvinyl chloride (PVC), ultraviolet (UV) light resistant polyethylene, or rubber used to prevent the infiltration or exfiltration of water into or out of sewage treatment devices such as site constructed sand filters or constructed wetlands.

**Food service wastes:** wastes generated from commercial food service operations that contain high amounts grease, fats or oils, including wastes from food service sinks, disposals, and floor drains.

**Footprint:** area under an existing or proposed structure as shown on plans.

**Grade:** ratio of the difference in elevation and the difference in horizontal distance between two points, expressed as a ratio in the same units, and commonly stated as rise over run. For example, a grade of two tenths (0.2) feet to one hundred (100) feet (0.2:100) is the difference in elevation of two tenths (0.2) feet (rise) over a horizontal distance of one hundred (100) feet (run).

**Grade, existing:** grade of the surface of soil, soil material, or fill.

**Grade, final:** grade of the surface of soil material after completion of landscaping operations.

**Grade, original:** grade of the surface of soil.

**Grade, positive:** downward inclination between two points such that the beginning point is at a higher elevation than the ending point.

**Grade, side-slope:** the grade of the sides of a sand mound or other embankment, expressed by surveying convention as the ratio of the difference in horizontal distance and the difference in elevation between two points (run over rise). This convention is the inverse of the ratio for grade defined above. For example, a side-slope grade of three to one (3:1) is the difference in horizontal distance of three (3) feet (run) over an elevation difference of one (1) foot (rise); a side-slope grade of greater than 3:1 refers to an increase in the numerator of this ratio, as in a side-slope grade of 4:1.

**Guiderail:** corrosion resistant device used for conveying the plumbing connector of the pump to and from the plumbing connection of the force main within the dose tank or lift station without entering the dose tank or lift station.

**High strength waste:** "High strength waste" means septic tank effluent quality in excess of two-hundred and fifty (250) mg/L for biochemical oxygen demand ($BOD_5$) or total suspended solids (TSS).

**Hydraulic loading rate:** the rate at which effluent may be applied to an infiltrative surface, expressed in gallons per square foot per day ($gpd/ft^2$).

**Infiltrative surface:** surface used for the absorption of effluent by soil. For trench systems, trench sidewalls are not included in the calculation of the total infiltrative surface area required for the onsite system.

**Level:** condition of grade or slope where the difference in elevation (rise) is zero for a given horizontal distance (run).

**Local health board:** local board of health of a local health department as referred to in IC 16-20.

**Local health department:** as defined in IC-16-18-2-211, "a department organized by a county or city executive with a board, a health officer, and an operational staff to provide health services to a county, city, or multiple county unit."

**Local health officer:** local health officer of a local health department as referred to in IC-16-20.

**Normal flow line:** median flow level of water in an open ditch, channel, river, stream, lake, pond, or reservoir.

**Normal high water mark:** highest elevation of water in an open ditch, channel, river, stream, lake, pond, or reservoir during non-flood times of year.

**NRCS:** U.S. Department of Agriculture, Natural Resources Conservation Service.

**Onsite system:** all equipment and devices necessary for proper onsite conduction, collection, storage, and treatment of sewage, and absorption of sewage in soil, from a residence or commercial facility.

**Onsite system evaluation:** evaluation of an existing onsite system that is in failure to determine the cause of failure, and whether the onsite system requires repair or replacement.

**Onsite system failure:** an onsite system that exhibits one or more of the following:

1. Soil absorption field refuses to accept sewage at the rate of application, thereby interfering with the normal use of plumbing fixtures or resulting in the discharge of effluent to the ground surface or to surface waters.

2. Failure of, or damage to, any component of an onsite system, thereby interfering with the normal use of plumbing or resulting on the discharge of effluent to the ground surface or to surface waters.
3. Effluent discharged from the onsite system causing contamination of a potable water supply, ground water, or surface water.

As used throughout this document, “failure” means “onsite system failure”.

**Onsite system repair:** the repair or replacement of any onsite system component with a like component other than the repair, replacement or expansion of a soil absorption field. As used throughout this document, “repair” means “onsite system repair”.

**Onsite system replacement:** the replacement or expansion of a soil absorption field.

**Onsite system, alternative technology:** an onsite system that includes:

1. A component, equipment, secondary treatment device, or high strength waste device not described in Technical Specification for Onsite Sewage Systems, 2003 Edition, for which sufficient research documentation, field performance documentation, or data for use in Indiana has been documented demonstrating that it meets department standards.
2. An alternative technology soil absorption field.

**Onsite system, cluster:** an onsite system shared by two (2) or more residences, or two (2) or more commercial facilities, or any combination thereof.

**Onsite system, commercial facility:** onsite system for a commercial facility.

**Onsite system, experimental technology:** an onsite system that includes:

1. A component, equipment, secondary treatment device, or high strength waste device not described in Technical Specification for Onsite Sewage Systems, 2003 Edition, for which sufficient research, field performance, or data for use in Indiana has not been documented demonstrating that it meets department standards.
2. An experimental soil absorption field technology.

**Onsite system, residential:** onsite system for a residence or a residential outbuilding.

**Owner:** deed holder of record.

**Person:** any individual, partnership, co-partnership, corporation, company, firm, association, society, holding company, trust, trustee, estate, school corporation, school city, school town, school district, any unit of government, or any other legal entity, its or their successors or assigns, or agent of the aforesaid.

**Pipe, drainpipe:** pipe with holes or slots located in the bottom of a trench which is back filled with aggregate. It is used to intercept, collect and conduct excess gravitational water away from a soil absorption field.

**Pipe, effluent sewer:** pipe that carries effluent by gravity. It is located between the septic tank and the distribution box in gravity onsite system, between the septic tank and the dose tank in flood dose, trench pressure, and sand mound onsite system, and between the distribution box and gravity distribution laterals in gravity, alternating fields, and flood dose onsite systems.

**Pipe, effluent force main:** pipe that carries effluent under the pressure of a pump from the dose tank to the distribution box in flood dose onsite system or manifold in trench pressure and sand mound onsite systems.

**Pipe, gravity distribution lateral:** pipe with holes that is located in the aggregate of soil absorption field trenches of gravity, alternating field, and flood dose onsite systems and that distributes effluent to the soil.

**Pipe, gravity sewer:** pipe, starting two (2) feet outside a structure, that carries sewage from the residential or commercial drain to an onsite system or sewerage system.

**Pipe, manifold:** pipe, located at the end of the force main in trench pressure and sand mound onsite systems, that distributes effluent to pressure distribution laterals.

**Pipe, pressure distribution lateral:** pipe with holes that distributes effluent under the pressure of a pump to the soil. It is located in the aggregate of soil absorption field trenches of the trench pressure onsite system, and in the aggregate bed of sand mound onsite systems.

**Pipe, sewage force main:** pipe that carries sewage under pressure of a pump from a sewage lift station to a sewer.

**Plan submittal:** all information required for the local health department or department to review the design, location, construction, maintenance, and operation of a proposed onsite system. A plan submittal includes, but is not limited to, an application, written site evaluation report, property plat and onsite system plan.

**Plat plan:** official plat of a property, required by IC-36-7-3, and as recorded through a local or county plan commission, or the office of the recorder of a county where no plan commission exists.

**Plow pan:** a compacted layer of soil formed during tilling operations. It typically results from tilling with a moldboard plow, causing excessive smearing and compaction. It is also referred to cultivation pan, furrow pan, or tillage pan.

**Ponding:** seasonal high water table at a higher elevation than the existing soil surface.

**Positive outlet:** device or structure allowing for drainage by gravity.

**Primary treatment:** a waste treatment process that takes place in a treatment unit and allows those substances in sewage that readily settle or float to be separated from the sewage being treated. Primary treatment is typically achieved through the use of a septic tank.

**PVC:** polyvinyl chloride.

**Public water supply:** public water supply as defined in IC 13-11-2-177.

**Recirculating sand filter:** a filter using a sand media for secondary treatment of septic tank effluent in which a portion of the filtered effluent is mixed with septic tank effluent in a recirculation tank for application to the filter. OR… A biological and physical treatment process consisting of a bed of sand to which septic tank effluent is distributed and then collected with the collected effluent recirculated through the sand bed filter and/or recirculating tank prior to discharge to the soil absorption system.

**Redoximorphic features:** soil characteristics formed by the processes of reduction, translocation and oxidation of iron and manganese oxides in seasonally saturated soils.

**Regulated facility:** any facility regulated under Indiana Administrative Code of the department or other state agency such as a school facility, a child care facility, a long-

term care facility, an acute care facility, a correctional facility, a state facility, a mobile home park, a campground, or an agricultural labor camp.

**Regulatory (Base) flood elevation:** Elevation of any flood having a one (1) percent probability of being exceeded or equaled on any given year, as calculated by a method and procedure which is acceptable to and approved by the Indiana Department of Natural Resources.

**Residence:** a single structure, used or intended to be used for permanent or seasonal human habitation for sleeping one (1) or two (2) families.

**Residential outbuilding:** a building, for the private use of the owner, located on the property of a residence and not intended to be used for permanent or seasonal human habitation or sleeping.

**Runoff:** that portion of precipitation or irrigation on a landform that does not infiltrate soil, but instead discharges from the landform (often called surface runoff).

**Sanitary vault privy:** a device, using a watertight vault, for the collection of human excrement. It does not mean a composting toilet or an incinerating toilet.

**Seasonal high water table ($SH_2O$):** upper limit of soil saturated with water for periods long enough for anaerobic conditions to affect soil color. In some cases, a dry zone may underlie the seasonal high water table.

**Secondary treatment:** any biological, chemical or physical process or system for improving sewage effluent quality after primary treatment in a septic tank and prior to discharge to a soil absorption field.

**Septic tank:** watertight structure into which sewage discharges for settling and anaerobic solids digestion.

**Sewage:** all human excrement and water-carried waste derived from ordinary living processes. For the purposes of 410 IAC 6-8.2, sewage is wastewater.

**Sewage, effluent:** see effluent

**Sewerage system:** system of sewers that conveys sewage away from a property on which it originates to a WTP.

**Slope** *(*see also *downslope* and *upslope)*: ratio of the difference in elevation and the difference in horizontal distance between two points on the surface of a landform, expressed as a percent, and commonly stated as rise over run. For example, a slope of one (1) percent is the difference in elevation of one (1) foot (rise) over a horizontal distance of one hundred (100) feet (run).

**Slope, positive:** downward inclination between two points on a landform such that the beginning point is at a higher elevation than the ending point.

**Slope, toe:** component of a slope that forms a gentle inclined surface at the base of a hill and grades into a valley or closed depression.

**Smearing:** mechanical sealing of the natural pores of soil along an excavated or tilled surface.

**Soil:** natural, non-filled, mineral or organic matter on the surface of the earth that shows the effects of genetic and environmental factors. These factors include climate (water

and temperature effects), microorganisms, macro-organisms, and topography acting on a parent material over time.

**Soil absorption:** process that uses soil to treat and dispose of effluent.

**Soil absorption field:** the portion of the onsite system into which effluent discharges for absorption by the soil.

**Soil absorption field, alternative technology:** any soil absorption field technology or design not described in Technical Specification for Onsite Sewage Systems, 2003 Edition, Chapters 6 and 7 for which sufficient research, field performance, or data for use in Indiana has been documented demonstrating that it meets department standards.

**Soil absorption field, experimental technology:** any soil absorption field technology or design not described in Technical Specification for Onsite Sewage Systems, 2003 Edition, Chapters 6 and 7 for which sufficient research, field performance, or data for use in Indiana has not been documented demonstrating that it meets department standards.

**Soil boring:** small diameter excavation used to provide a soil profile analysis.

**Soil compaction:** increase in soil bulk density caused by the application of mechanical forces. Soil compaction results in reduced soil porosity and reduced soil permeability.

**Soil, densic material (USDA, NRCS):** relatively unaltered materials (do not meet requirements for any other named diagnostic horizons nor any other diagnostic soil characteristic) that have a noncemented rupture-resistance class. The bulk density or the organization is such that roots cannot enter, except in cracks. These are mostly earthy materials, such as till, volcanic mudflows, and some mechanically compacted materials, for example, mine spoils. Some noncemented rock can be densic materials if they are dense or resistant enough to keep roots from entering, except in cracks. Densic materials are noncemented and thus differ from paralithic materials and the material below a lithic contact, both of which are cemented. Densic materials have, at their upper boundary, a densic contact if they have no cracks or if the spacing of cracks that roots can enter is ten (10) centimeters (cm) or more. These materials can be used to differentiate soil series if the materials are within the series control section.

**Soil horizon:** layer of soil or soil material approximately parallel to the land surface and differing from adjacent genetically related layers in physical, chemical, and biological properties. These properties include soil color, structure, texture and consistency, kinds and numbers of organisms present, and degree of acidity or alkalinity.

**Soil loading rate, SLR:** design rate at which effluent may be applied to the infiltrative surface of a soil absorption field, expressed in gallons per square foot per day ($gpd/ft^2$).

**Soil material:** any soil displaced from its original position within a soil profile.

**Soil munsell® notation:** a standard designation of color by degrees of three variables—hue, value, and chroma.

**Soil pit:** large excavation made into soil where a sidewall is exposed for examination to provide a soil profile analysis.

**Soil profile:** vertical section of the soil through all its horizons and extending into the underlying parent material.

**Soil profile report:** a written description and interpretation of the physical and chemical properties of a soil, from soil sample sites, using the guidelines set forth in soil manuals, technical bulletins, and handbooks of the NRCS.

**Soil sample site:** boring or pit at a soil absorption field site.

**Soil scientist:** individual registered as a professional soil scientist with the Indiana Registry of Soil Scientists (IRSS) as provided for under IC 25-31.5.

**Soil, cover:** mineral soil material, capable of sustaining plant growth, placed over a soil absorption field.

**Storm water detention basin:** excavation with a positive outlet that completely empties all water between storms.

**Storm water detention pond (or wet bottom detention basin):** excavation with a permanent water level and positive outlet that empties the volume of storm runoff between storms.

**Storm water retention facility:** excavation with no positive outlet that retains storm runoff for an indefinite amount of time. It removes water only though infiltration in the soil and evaporation.

**Structure:** anything that alters the natural flow of surface or subsurface water. Structures include, but are not limited to, residences, commercial facilities, foundations, slabs, garages, patios, barns, above and below ground swimming pools, retaining walls, roads, driveways, and parking areas.

**Submersible effluent pump:** a pump that pumps only wastewater effluent with minimal solids and is totally submerged in the wastewater of the dosing tank or lift station.

**Tank(s):** a rectangle or cylindrical vessel used to store, treat and dispose of wastewater. Including but not limited to: privy vaults, temporary sewage holding tanks, septic tanks, dosing tanks, and aeration treatment units (ATU's).

**Technical specification:** document incorporated by reference in IAC 410 6-8.2 entitled *"Technical Specification for On-Site Sewage Disposal, 2001 Edition")*.

**Temporary sewage holding tank:** a watertight tank temporarily used to receive and store sewage pending its delivery to an approved treatment facility.

**Total nitrogen (TN):** the combined organic nitrogen, ammonia, nitrite and nitrate (expressed in mg/L) as analyzed in accordance with *Standard Methods for the Examination of Wastewater.*

**Total suspended solids (TSS):** the quantity of solids (expressed as mg/L) which can be readily removed from a well-mixed sample with standard laboratory filtering procedures in accordance with *Standard Methods for the Examination of Water and Wastewater.*

**Trench depth, final:** vertical distance from final grade after placement of cover soil and landscaping to the infiltrative surface of an absorption trench.

**Trench depth, original:** vertical distance from existing grade to the infiltrative surface of an absorption trench.

**Upslope:** upward inclination between two points on a landform such that the beginning point is at a lower elevation than the ending point.

**Waste pipes:** system of pipes in a residence, or commercial facility, that carries sewage to a residential or commercial drain.

**Wastewater:** see sewage.

**Wastewater treatment plant (WTP):** a system of treatment works as defined in IC 13-11-2-258 installed to treat sewage, industrial wastes, or other wastes delivered by a system of sewers, whether owned or operated the state, a municipality, or a person, firm, or corporation. The term does not include onsite systems.

**Water supply well:** any annular excavation used for drawing water out of the ground.

**Wetland:** land so defined by the U.S. Army Corps of Engineers.

# Appendix B: Terms

| | |
|---|---|
| AB | width, aggregate bed |
| d | diameter |
| DDF | design daily flow |
| fps | feet per second |
| gpd | gallons per day |
| $gpd/ft^2$ | gallons per day per square foot |
| gpm | gallons per minute |
| gpm/hole | gallons per minute per hole |
| gpm/lf | gallons per minute per lineal foot |
| $H_D$ | design head |
| $H_F$ | friction loss head |
| $H_S$ | static head |
| IDEM | Indiana Department of Environmental Management |
| IDNR | Indiana Department of Natural Resources |
| INDOT Spec. # | Indiana Department of Transportation Standard Specifications for Aggregates and Sand |
| L | length |
| $lateral_{OD}$ | outside diameter, distribution lateral |
| LDR | lateral discharge rate |
| lf | lineal foot |
| psi | pounds per square inch |
| Q | flow (in gpm) |
| SLR | soil loading rate |
| TDH | total dynamic heal |
| TDR | total discharge rate |
| TW | total width |
| V | velocity |
| vol | volume |
| $vol_{FM}$ | volume, force main |
| $vol_M$ | volume, manifold |
| W | width |

# Appendix C: Figures

## Figure 3-4
## Soil Loading Rates for OSS[1,2]

| Texture | Structure/Consistence | | | | | | |
|---|---|---|---|---|---|---|---|
| | without densic material or fragic soil properties | | | | | | densic material or fragic soil properties |
| | sg | gr, pl[2] | strong abk sbk pr | moderate abk sbk pr | weak abk sbk pr | structureless massive | |
| Gravel (GR)<br>Very Coarse Sand (VCOS) | > 1.20 | | | | | | < 0.25 |
| Loamy Very Coarse Sand (LVCOS)<br>Coarse Sand (COS) | > 1.20 | | | | | | < 0.25 |
| Medium Sand[3] (S) | 1.20 | 1.20 | | | 1.20 | | < 0.25 |
| Loamy Coarse Sand (LCOS) | 1.20 | 1.20 | | | 1.20 | | < 0.25 |
| Fine Sand (FS)<br>Very Fine Sand (VFS) | 0.60 | 0.60 | | 0.60 | 0.60 | 0.60 | < 0.25 |
| Loamy Sand (LS)<br>Loamy Fine Sand (LFS)<br>Loamy Very Fine Sand (LVFS) | 0.75 | 0.60 | | 0.75 | 0.75 | 0.75 | < 0.25 |
| Coarse Sandy Loam (COSL)<br>Sandy Loam (SL) | | 0.60 | | 0.60 | 0.60 | 0.60 | < 0.25 |
| Fine Sandy Loam (FSL)<br>Very Fine Sandy Loam (VFSL) | | 0.75 | | 0.60 | 0.60 | 0.60 | < 0.25 |
| Loam (L) | | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | < 0.25 |
| | | 0.75 | 0.75 | 0.50 | 0.50 | 0.50 | < 0.25 |
| Silt Loam (SIL) | | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | < 0.25 |
| Silt (SI) | | 0.75 | 0.75 | 0.50 | 0.30 | 0.30 | < 0.25 |
| Sandy Clay Loam (SCL) | | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | < 0.25 |
| | | 0.60 | 0.60 | 0.50 | 0.30 | 0.30 | < 0.25 |
| Clay Loam (CL)<br>Silty Clay Loam (SICL) | | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | < 0.25 |
| Sandy Clay (SC) | | 0.60 | 0.60 | 0.30 | 0.25 | 0.25 | < 0.25 |
| Silty Clay (SIC) | | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | < 0.25 |
| Clay (C) | | 0.60 | 0.50 | 0.30 | 0.25 | 0.25 | < 0.25 |
| Bedrock, Marl, Muck, Ortstein, and Peat | SLR of < 0.25 or SLR > 1.2, whichever is applicable | | | | | | |
| | SLR of < 0.25 or SLR > 1.2, whichever is applicable | | | | | | |

**Legend for Determining SLRs:**

- Above Ground OSDS
- Subsurface OSDS
- Not Applicable

**Shape of Structure:**

sg: single grained
gr: granular
pl: platy
abk: angular blocky
sbk: subangular blocky
pr: prismatic

## Figure 3-4
### Soil Loading Rates for OSS[1,2]

[1] Mine spoils and fill are excluded from this table.

[2] The following are assigned a soil loading rate (SLR) of < 0.25 gpd/ft$^2$ or a SLR > 1.2 gpd/ft$^2$, whichever is applicable:

- compact glacial till (see densic material, special note B.);
- coprogenous earth;
- fragipan;
- soils that have fragic soil properties (see special note C.);
- platy structure (pl) caused by compaction;
- massive structure with firm and very firm consistence and a texture that contains seventy (70) percent or less sand; and
- soils with more than thirty-five (35) percent [weighted average volume within upper forty (40) inches of soil profile] of rock fragments greater than three (3) inches in diameter.

[3] Has a particle size of 0.25 to 0.50 millimeters (mm).

**SPECIAL NOTES:**

A. The transitional BC, Bk and CB horizons, that developed in glacial till and have soil properties that are similar to densic material (see special note B.), are assigned the same SLR as the underlying C horizons.

B. Densic materials (USDA, NRCS) are relatively unaltered materials (do not meet requirements for any other named diagnostic horizons nor any other diagnostic soil characteristic) that have a noncemented rupture-resistance class. The bulk density or the organization is such that roots cannot enter, except in cracks. These are mostly earthy materials, such as till, volcanic mudflows, and some mechanically compacted materials, for example, mine spoils. Some noncemented rocks can be densic materials if they are dense or resistant enough to keep roots from entering, except in cracks.
Densic materials are noncemented and thus differ from paralithic materials and the material below a lithic contact, both of which are cemented.
Densic materials have, at their upper boundary, a densic contact if they have no cracks or if the spacing of cracks that roots can enter is ten (10) centimeters (cm) or more. These materials can be used to differentiate soil series if the materials are within the series control section.

C. Fragic soil properties (USDA, NRCS) are the essential properties of a fragipan. They have neither the layer thickness nor volume requirements for the fragipan. Fragic soil properties are in subsurface horizons, although they can be at or near the surface in truncated soils. Aggregates with fragic soil properties have a firm or firmer rupture-resistance class and a brittle manner of failure when soil water is at or near field capacity. Air-dry fragments of the natural fabric, five (5) to ten (10) centimeters (cm) in diameter, slake when they are submerged in water. Aggregates with fragic soil properties show evidence of pedogenesis, including one or more of the following: oriented clay within the matrix or on faces of peds, redoximorphic features within the matrix or on faces of peds, strong or moderate soil structure, and coatings of albic materials or uncoated silt and sand grains on faces of peds or in seams. Peds with these properties are considered to have fragic soil properties regardless of whether or not the density and brittleness are pedogenic.

| Figure 5-1<br>Standards for Calculating Sewage Flows for Commercial Facilities* | |
|---|---|
| **Type of Establishment** | **Design Daily Flow, DDF (gpd)** |
| Agricultural Labor Camp | 50 per occupant |
| Airport | 3 per passenger<br>20 per employee |
| Apartment | 200 per one-bedroom<br>300 per two-bedroom<br>350 per three-bedroom |
| Assembly Hall | 3 per seat |
| Athletic Field (Baseball, soccer, etc.) | 1 per participant and spectator with additions for concession stands |
| Auction & Flea Market | 3 per customer |
| Banquet Caterer | 10 per person |
| Beauty Salon<br>a. perm or color changes<br>b. cut with wash<br>c. cut without wash | <br>35 per customer<br>10 per customer<br>5 per customer |
| Bed & Breakfast | 150 per bedroom |
| Bowling Alley<br>a. with bar and/ or food<br>b. without food service | <br>125 per lane<br>75 per lane |
| Bus Station | 3 per passenger |
| Campground<br>Organizational:<br>a. with flush toilets, showers, central kitchen<br>b. without flush toilets, privy use, central dining hall, no showers, handwashing<br>Recreational:<br>a. with individual sewer connection (independent)<br>b. without individual sewer connection (dependent) | <br><br>40 per camper<br>20 per camper<br><br><br>50 per campsite<br>50 per campsite |
| Church<br>a. with full kitchen<br>b. with warming kitchen<br>c. without kitchen | <br>5 per sanctuary seat<br>4 per sanctuary seat<br>3 per sanctuary seat |

| Figure 5-1<br>Standards for Calculating Sewage Flows for Commercial Facilities* | |
|---|---|
| **Type of Establishment** | **Design Daily Flow, DDF (gpd)** |
| Condominium<br>Multi-Family Dwelling<br>a. one-bedroom<br>b. two-bedroom<br>c. three-bedroom | <br><br>200 unit<br>300 unit<br>350 unit |
| Conferences | 10 per attendee |
| Correctional Facilities | 120 per inmate |
| Day Care Centers | 20 per person |
| Dentist Office | 200 per chair<br>75 per dentist<br>75 per dental technician<br>20 per support staff |
| Doctor's Office | 75 per doctor<br>75 per nurse<br>20 per support staff |
| Factory<br>a. with showers<br>b. without showers | <br>35 per employee<br>20 per employee |
| Fire Station<br>a. Manned<br>b. Unmanned | <br>75 per fireman<br>35 per fireman |
| Food Service Operations<br>a. Restaurant (not 24-hour)<br>b. Restaurant, 24-hour<br>c. Restaurant (not 24-hour), along Interstate<br>d. Restaurant, 24-hour, along Interstate<br>e. Tavern/Cocktail Lounge<br>f. Curb Service (drive-in) | <br>35 per seat<br>50 per seat<br>50 per seat<br>70 per seat<br>35 per seat<br>50 per car space |
| Golf comfort station (mid-course) | 1.5 times maximum number of golfers |
| Golf (main clubhouse) | 5 times maximum number of golfer with additions for food service & showers |
| Hospital, medical facilities | 200 per bed |
| Hotels | 100 per room |

| Figure 5-1<br>Standards for Calculating Sewage Flows for Commercial Facilities* | |
|---|---|
| **Type of Establishment** | **Design Daily Flow, DDF (gpd)** |
| Kennels & Vet Clinics<br>a. Cages<br>b. Inside Runs<br>c. Outside Runs<br>d. Grooming<br>e. Surgery<br>Staff: | <br>5 per cage<br>10 per run<br>20 per run<br>10 per animal<br>50 per surgery room<br>75 per veterinary doctor<br>75 per veterinary assistant<br>20 per support staff |
| Mental Health Facility | 100 per patient |
| Mobile Home Park | 200 per lot |
| Motel | 100 per room |
| Nursing Home | 100 per bed |
| Office Building<br>a. without showers<br>b. with showers | <br>20 per employee<br>35 per employee |
| Outpatient Surgical Center | 50 per patient |
| Picnic Area | 5 per visitor |
| Race Tracks<br>a. Attendee<br>b. Staff | <br>5 per attendee<br>20 per staff |
| Residential Cluster OSS | 120 per bedroom |
| School<br>a. Elementary<br>b. Secondary | <br>15 per pupil<br>25 per pupil |
| Service Stations<br>a. Convenience store/service center<br>b. Station with only 2 restrooms<br>c. Station with only unisex restroom<br>d. Automatic Self Cleaning Bathroom | <br>1000 w/ additions for food prep. & seating<br>400 per restroom<br>600 per restroom<br>60 per day |
| Shopping Center | 0.1 per square foot of floor space,<br>plus 20 per employee |
| Swimming Pool Bathhouse | 10 per swimmer |
| Theater<br>a. Drive-in<br>b. Inside Building | <br>5 per car space<br>5 per seat |
| * For establishments not mentioned in this figure, contact the department before design. | |

## Figure 5-4

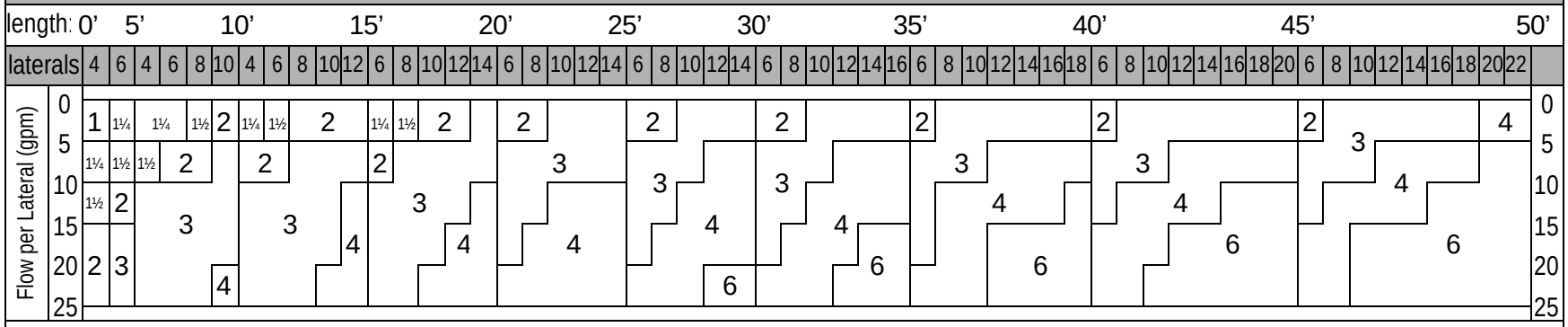
## Pipe Diameter, Flow (gpm), Velocity (v), and Friction Loss Head ($H_f$)[1]

| Flow (gpm) | 1” | | 1 ¼” | | 1 ½” | | 2” | | 2 ½” | | 3” | | 4” | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q | v | $H_f$ | v | $H_f$ | v | $H_f$ | v | $H_f$ | v | $H_f$ | v | $H_f$ | v | $H_f$ |
| 1 | .37 | .11 | | | | | | | | | | | | |
| 2 | .74 | .38 | .43 | .10 | | | | | | | | | | |
| 3 | 1.11 | .78 | .64 | .21 | .47 | .10 | | | | | | | | |
| 4 | 1.49 | 1.31 | .86 | .35 | .63 | .16 | | | | | | | | |
| 5 | 1.86 | 1.92 | 1.07 | .52 | .79 | .24 | | | | | | | | |
| 6 | 2.23 | 2.70 | 1.29 | .71 | .95 | .33 | .57 | .10 | | | | | | |
| 8 | 2.97 | 4.59 | 1.72 | 1.19 | 1.26 | .56 | .77 | .17 | | | | | | |
| 10 | 3.71 | 6.90 | 2.15 | 1.78 | 1.58 | .83 | .96 | .25 | .67 | .11 | | | | |
| 15 | 5.57 | 14.7 | 3.22 | 3.76 | 2.37 | 1.74 | 1.43 | .52 | 1.01 | .22 | | | | |
| 20 | 7.43 | 25.2 | 4.29 | 6.42 | 3.16 | 2.96 | 1.91 | .87 | 1.34 | .37 | .87 | .13 | | |
| 25 | 9.28 | 38.6 | 5.37 | 9.74 | 3.94 | 4.46 | 2.39 | 1.29 | 1.68 | .54 | 1.09 | .19 | | |
| 30 | | | 6.44 | 13.6 | 4.73 | 6.27 | 2.87 | 1.81 | 2.01 | .76 | 1.30 | .26 | | |
| 35 | | | 7.51 | 18.2 | 5.52 | 8.40 | 3.35 | 2.42 | 2.35 | 1.01 | 1.52 | .35 | .88 | .10 |
| 40 | | | 8.59 | 23.6 | 6.30 | 10.7 | 3.83 | 3.12 | 2.68 | 1.28 | 1.74 | .44 | 1.01 | .12 |
| 45 | | | | | 7.09 | 13.5 | 4.30 | 3.85 | 3.02 | 1.54 | 1.95 | .55 | 1.13 | .15 |
| 50 | | | | | 7.88 | 16.5 | 4.78 | 4.68 | 3.35 | 1.93 | 2.17 | .67 | 1.26 | .18 |
| 60 | | | | | 9.47 | 23.6 | 5.74 | 6.62 | 4.02 | 2.72 | 2.60 | .94 | 1.51 | .25 |
| 70 | | | | | | | 6.70 | 8.86 | 4.69 | 3.67 | 3.04 | 1.25 | 1.76 | .33 |
| 80 | | | | | | | 7.65 | 11.5 | 5.36 | 4.69 | 3.47 | 1.59 | 2.02 | .42 |
| 90 | | | | | | | 8.60 | 14.3 | 6.03 | 5.83 | 3.91 | 1.99 | 2.27 | .52 |
| 100 | | | | | | | | | 6.70 | 7.13 | 4.34 | 2.42 | 2.52 | .63 |
| 125 | | | | | | | | | 8.38 | 10.9 | 5.43 | 3.72 | 3.15 | .96 |
| 150 | | | | | | | | | | | 6.51 | 5.16 | 3.78 | 1.34 |
| 175 | | | | | | | | | | | 7.60 | 6.90 | 4.41 | 1.79 |
| 200 | | | | | | | | | | | 8.68 | 8.93 | 5.04 | 2.27 |
| 225 | | | | | | | | | | | | | 5.67 | 2.84 |
| 250 | | | | | | | | | | | | | 6.30 | 3.37 |
| 275 | | | | | | | | | | | | | 6.93 | 4.13 |
| 300 | | | | | | | | | | | | | 7.56 | 4.87 |
| 325 | | | | | | | | | | | | | 8.19 | 5.70 |

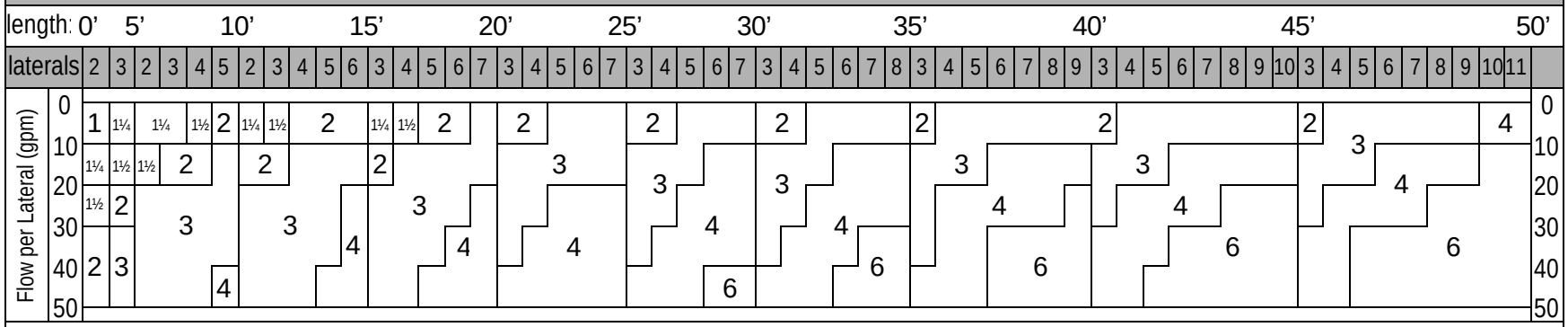
[1] This figure is based on flows for PVC Schedule 40 pipe (flow coefficient: C-150). Other values for friction loss may be used if documentation from the pipe manufacturer is provided with the plan submittal. Calculations using the Hazen-Williams equation may be used if provided with the plan submittal.

## Figure 5-5
## Determination of Manifold Diameters (inches)[1]

### Pressure Distribution System with Center Manifold




### Pressure Distribution System with End Manifold




[1] This figure is based on flows for PVC Schedule 40 pipe (flow coefficient: C-150). Other values for friction loss may be used if documentation from the pipe manufacturer is provided with the plan submittal. Calculations using the Hazen-Williams equation may be used if provided with the plan submittal. The maximum manifold length for a given lateral discharge rate and spacing was defined as that length at which the difference between the heads at the supply and distal ends of the manifold exceeded 10%.